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EPONYMS.

BY SIR D'ARCY POWER, K.B.E., LONDON.

XXIV. GAMGEE'S TISSUE.

MR. SAMPSON GAMGEE, Surgeon to the Queen's Hospital at Birmingham, gave an epoch-making clinical lecture to his students on Feb. 18, 1880. He called the subject of his lecture "On Absorbent and Antiseptic Surgical Dressings", and by it gave the death-blow to the poultice which was then in ordinary use. He said in this lecture:—

"Let me detain you for a few moments with an experimental demonstration of the action of the materials employed as dressings in the cases I have been speaking about. Here is a piece of the finest cotton-wool, such as is ordinarily used by jewellers. You see it floats on water, and rises to the surface any number of times after being pushed to the bottom of the glass. It will float for weeks, as I have proved by repeated trials. I drop into a tumbler of water this pledget of cotton-wool, made absorbent by the removal of oily matter and other impurities, and you see that it sinks to the bottom in a very few seconds. I now envelope a pledget of absorbent cotton in a piece of unbleached gauze, such as is commonly used in surgical practice. In spite of the proved absorbing power of the contained cotton-wool, so impermeable is the gauze that the pledget floats and resists forcible immersion. I have had a little pad so made, floating in a tumbler of water in my study for thirty-five days. If, however, you make a little pad with the absorbent cotton-wool and the same kind of gauze, bleached, you will find the substance sucks up the water with avidity, and sinks at once. So with the bandages. Here is a piece of ordinary calico bandage; it floats in the basin like a plank on a pond. Here is a piece of open wove bandage absorbent; it sinks the instant I drop it on to the water.

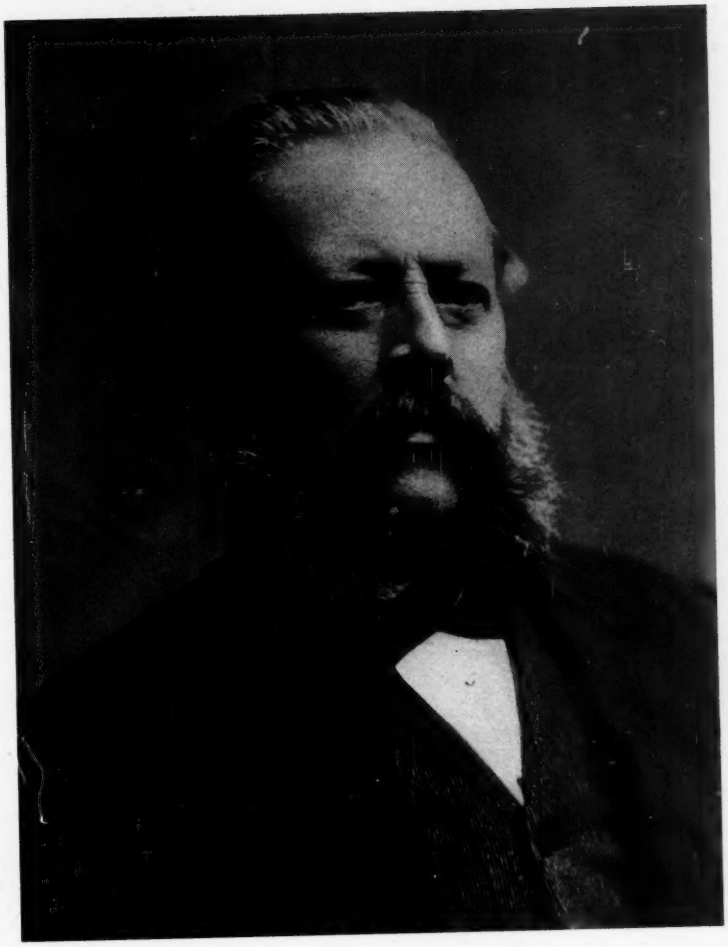
"Once I had ascertained these facts, I lost no time in putting them to the test of clinical experience, which has demonstrated the great therapeutic value of the absorbent materials; discharges drain through them so readily that wounds are kept clean and the surrounding parts dry. Union rapidly and painlessly consolidates under the elastic pressure. So great is the elasticity of the material that the pad I hold in my hand is scarcely flattened, though it has been firmly bandaged on a man's instep for five days. On

holding the pad before the fire you see it puff up at once and quickly regain its fullness and downy softness.

"It is foreign to my present purpose to detain you with any theoretical speculations. Let us get at the facts before we speculate. Certain it is, that the perfect softness and elasticity of these absorbent materials are of the utmost practical value and comfort. Those qualities render possible, with the most perfect safety, the application of that elastic compression, which, with rest and position, is so potent in relieving local congestion and inflammation. That therapeutic action is most clearly and convincingly demonstrated in cases of injury unaccompanied with wound. Of all surgical agencies none is so beneficent as compression, none requiring more delicate manipulation, none so inadequately appreciated. Under a smooth and uniformly, while lightly, compressing bandage, applied to the head, the trunk, or the limbs, extravasations of blood are absorbed, the healing action is promoted and a soothing influence is exercised. There must be no constriction—only equable adaptation of surface to surface, with the light pressure which always comforts. There must be no squeezing like that of an old college friend's hand, when seen after a long absence; such pressure as that, on tender parts, is intolerable constriction. The soothing surgical pressure is like that which you interchange with the hand of a lady, when the pleasure of meeting her is tempered by a respectful regard. Your hand adapts itself to hers, and gently presses it wherever it can touch it, but nowhere squeezes it for fear of offending. Such pressure when employed by the surgeon in the treatment of injuries, always soothes and heals.

"The greatest comfort is experienced when one of these layers of absorbent cotton in a double layer of similar gauze is applied in cases of inflammation of the lungs where the weight of a linseed poultice is found to be intolerable. When held before the fire the material puffs up, and is placed on the chest warm and soft as the finest down. The idea was suggested to me long since in reading the chapter on muslin and cotton-wool in the racy and most instructive essays on 'Simplified Surgery' published at Brussels in 1842 by Mayor, of Lausanne. I had often tried the application, but it was evident that the famed muslin manufactories of Switzerland had furnished better materials than I had hitherto been able to obtain. I found that ordinary cotton-wool and muslin did not work up well. This absorbent gauze and cotton-wool, however, is perfect, and I foresee that in many other cases, especially in dressing burns, blisters and bed sores the new tissue cannot fail to prove most useful. Obstetricians to whom I have suggested the use of these pads in child-bed, instead of napkins, have approved the idea and put it to the test of experience, which has been so far unanimously satisfactory. It is obvious that it must be most conducive to purity, and opposed to infection, to receive the natural discharges into a very readily absorbent and powerfully antiseptic pad, of downy softness, that is changed as often as is necessary and immediately burnt. On this point, however, having no obstetric practice myself, I cannot speak with any authority and only venture to suggest".

It may perhaps be interesting to notice that Dr. Mathias Mayor, of Lausanne, to whom Gamgee attributes the original idea of an absorbent



SAMPSON GAMGEE

1828-1886

UNIV. OF MICH.

dressing, was the first in Switzerland to use the stethoscope for the purpose of hearing the fœtal heart, and that he practised this form of auscultation on his wife before the birth of their son, who is happily still living. Mr. Sampson Gamgee within the compass of a single clinical lecture not only introduced a form of dressing which has since become a household word, but was also able to foreshadow nearly all the uses to which it has since been put.

Joseph Sampson Gamgee was the eldest son of Joseph Gamgee, a veterinary surgeon. He was born at Leghorn in 1828, and in the following year the family moved to Florence, where he was educated. He went to London in 1847 and was entered as a student at the Royal Veterinary College in Camden Town in order that he might follow his father's profession. He obtained his diploma as a Member of the Royal College of Veterinary Surgeons and then proceeded to University College, where he gained several gold medals and the Liston Prize for Surgery. He became a Member of the Royal College of Surgeons of England in 1854 and was appointed Surgeon to the British Italian Legion in 1855, being placed in charge of the hospital at Malta during the Crimean war. He was appointed Surgeon to the Queen's Hospital at Birmingham in 1857 and served both the hospital and the medical school with the greatest zeal until 1881. He was always strongly opposed to indiscriminate hospital relief, and in 1873 he was instrumental in starting the 'Hospital Saturday' collections in Birmingham, especially in factories and workshops. He married in 1860 Miss Marion Parker, by whom he had seven children. He died in 1886. His youngest brother was Arthur Gamgee [1841–1909], the first Brackenbury Professor of Physiology in the Owens College, Manchester, now the Victoria University, who, as Dean of the Medical School, did much to make it a conspicuous success.

For the portrait I am indebted to his son, Mr. Leonard P. Gamgee, F.R.C.S., Joint Professor of Surgery in the University of Birmingham and Surgeon to the Birmingham General Hospital.

THE SURGICAL TREATMENT OF THE 'DE-GLOVED' HAND.

By G. H. COLT, Aberdeen.

It has been too often assumed that a finger which has been completely skinned by an accident must be amputated. I hope to show that it should be possible to save and restore to functional use even the whole hand when injured in this manner.

Case 1.—On Dec. 5, 1919, Robert W., age 16, had his right hand caught in the hot rollers of a paper machine and all four fingers were completely skinned down to the aponeurosis from the level of the knuckles downwards. The tip of the distal phalanx of the middle and the whole distal phalanx of the ring finger were absent. There was a fracture of the middle phalanx of the middle finger, but it was not compound through the fascia. While deputizing for Professor Marnoch, to whom I am indebted for permission to publish the case, I saw the patient, and it naturally seemed to be a great misfortune to allow the fingers to be amputated. They were much soiled with grease and dirt. After being cleansed with ether and weak biniodide lotion they were placed inside the skin of the hypogastrium and the wound was drained. It suppurated severely and the fingers became contracted, but fortunately no sepsis spread up the arm. Six weeks later the skin was cut into flaps round about, the hand removed, and the flaps were folded round it like a mit. Some sloughing occurred on the palmar surface, where all along the chief suppuration had lain. A month later the raw area on the abdomen was grafted. *Fig.* 380 shows the condition of the hand four and a half months after the accident. At this stage a screw clamp separator was used to try to prepare the way between the middle and ring fingers. In the middle of June,

Fig. 380.—*Case* 1. Four and a half months after accident.

six and a half months after the accident, a pinprick was felt on the ulnar side of the dorsal surface of the mit. The middle and ring portions of the mit were separated and the palmar scar was excised. It was found that there was much internal scarring and the amount of skin was deficient. Most of

FIG. 381.—*Case* 1. Nine months after accident.

the middle finger was removed, and *Fig.* 381 shows the condition. On Aug. 10 (nine months) light touch was felt on the ulnar side of the inner fin. The ring finger was amputated through the distal part of the proximal phalanx, and on Dec. 1 more scar tissue and part of the remaining middle phalanx of

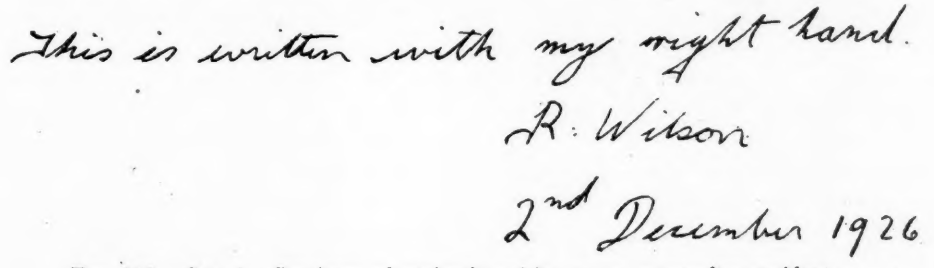
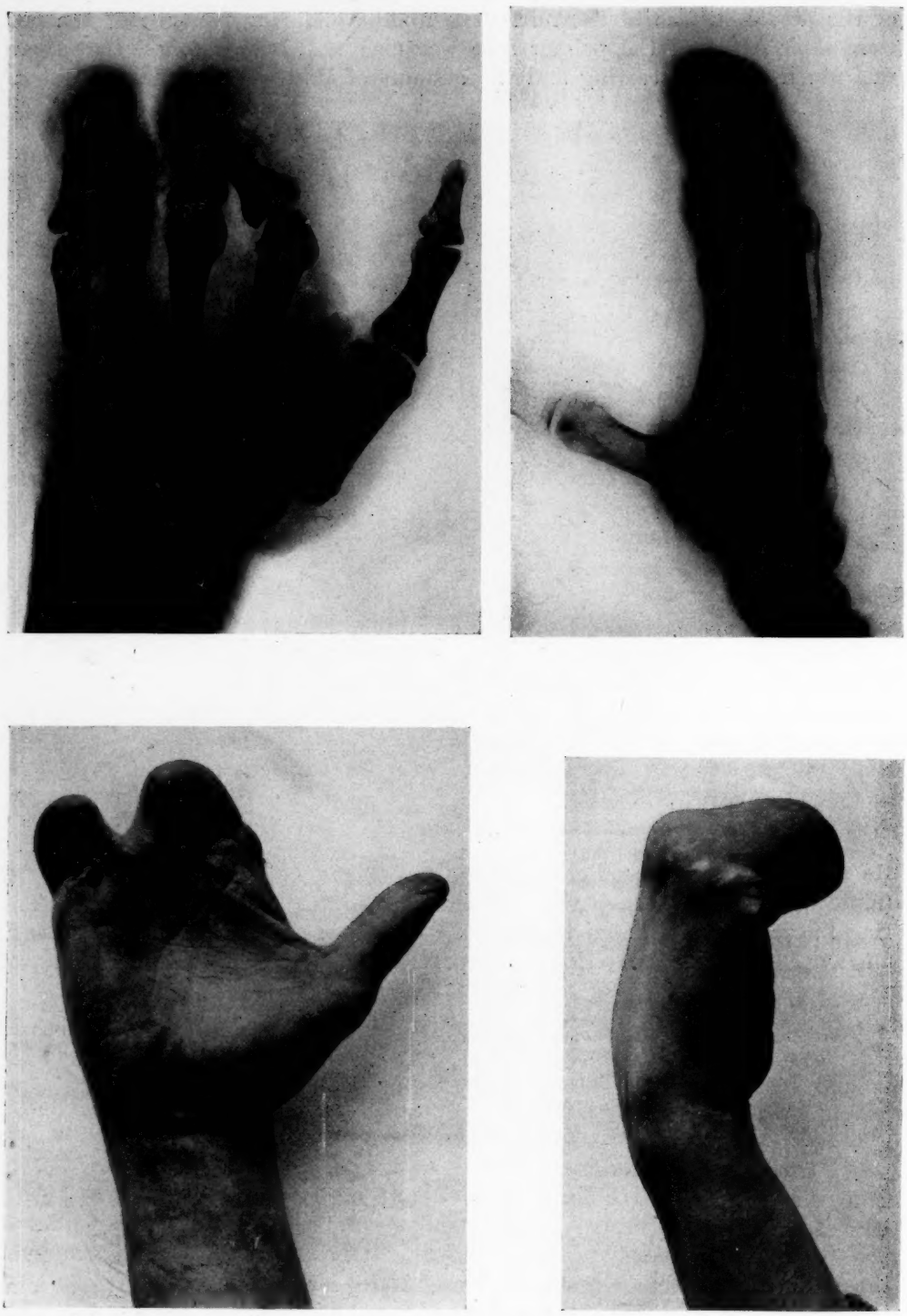


FIG. 382.—*Case* 1. Specimen of patient's writing seven years after accident.

the index finger were removed. These losses were due to scar tissue and insufficiency of skin. In March, 1921 (fifteen months) the patient was able to use the hand for writing. A specimen of his writing at the present time



FIGS. 383–386.—*Case* 1. Condition of hand seven years after accident.

is appended (*Fig.* 382). The specimens do not differ much. Light touch and pinprick were felt all over the stumps. Heat and cold were felt, but the latent period for heat was longer than that for cold. He could pick up a pin and grasp small objects firmly.

Since that time the patient has supported himself by photographic work for a year, and for the last four years by driving a motor van with right-hand controls. He has been married for a year and will be able to exercise due control over his son. *Figs.* 383–386 show the present condition, seven years after the accident. The skin is somewhat cold and blue in bad weather, but not painful, and it is extremely supple. The two fins move freely and independently, and the grasp is good.

An inference to be drawn from this case is that the abdominal wall is unsuitable for the purpose of the operation, because dependent drainage is difficult to secure and because pressure cannot be exercised to keep the fingers straight and separated from the beginning. How far pressure would be necessary on the abdominal wall if separate pockets were made for each digit is not yet known. The case was shown when the Chirurgical Club visited Aberdeen, and members will remember that for the reasons given the upper part of the thigh or hip was considered suitable in any future case, as advocated by Schroeder[1] in cases of secondary operation for burns. This case has now occurred.

Case 2.—Mrs. Jessie H., age 48, a well-nourished woman, was descending a movable stair ladder from a loft on April 24, 1926, holding the edge of the floor above with her right hand. The trap fell on her hand and the ladder slipped away with the result that her right hand was skinned on the dorsal aspect from the level of the distal crease of the wrist and on the palmar aspect from the level of the metacarpophalangeal joints downwards. The three outer fingers were involved completely and the nails were absent. The thumb and little finger escaped. The index finger had been torn off through the proximal phalanx. The patient had the sense to leave the skin where it was and to wrap the hand in a clean towel. She was brought to the infirmary and was admitted. The operation was begun about two and a half hours after the accident. Under general anæsthesia the hand was cleaned and disinfected with ether and a flavine bath and the tendons of the index finger were sutured over the stump. The edges of the torn skin were excised and a flap was raised in the thigh of a size and shape corresponding to the skin which was missing from the back of the hand. It is as well to mention that a mistake was nearly made by reason of the patient's arm being relatively short, but this was noticed in time. It is a point to note for the future so as to ensure an easy lie for the limb and an absence of tension in the flaps. Three tunnels were divulsed in the subcutaneous tissue and the three injured fingers were drawn into them from counter openings at their distal ends. Drains were inserted at the openings and also dependently to the deep surface. As subsequently appeared the tunnels were too near together. A point of great practical importance thus presented itself—namely, in the future to make all the tunnels as divergent as possible, as I find Schroeder points out. This fixes each finger securely, supplies a supple web, and yields more skin for covering the dorsal surface. The skin of the forearm was sutured to the

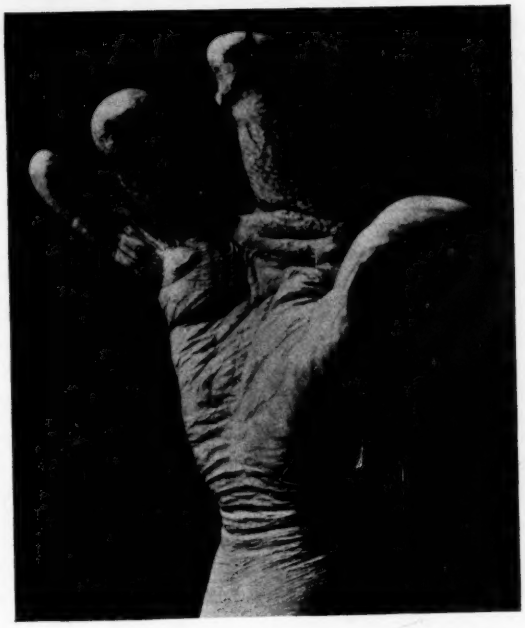
loin, so that if the patient moved, the drag would warn her to keep still. It appeared, however, that this is unnecessary in a well-nourished patient, as also

FIG. 387.—*Case* 2. In the figure the dot indicates the position of the anterior superior iliac spine. The crosses show the positions of the ends of the fingers, and the slots the places where drainage was provided. In addition dependent drainage was provided under the original outer flap. There are four stitches on the inner flap.

is a plaster casing, for a firm binder will keep the limb secure, and in a thin patient a pad would fill the gap at the loin. The fixation by separate tunnels also renders the use of a stent mould unnecessary. This was employed on the eighth day to aid the separation. If it became misplaced it might cause injurious pressure. Evenly distributed pressure by means of a careful arrangement of the dressings is sufficient. The drains were removed on the third day, when it was apparent that any violent sepsis was absent.

FIG. 388.—*Case* 2.

The skin of the outer flap was incised and sutured to the adjacent subcutaneous tissue a month after the primary operation. A week later the flap was separated and wrapped round the ring finger. The tip of the flap died. *Fig.* 387 shows the general arrangement of the parts. The inner flap was treated



FIGS. 389–391.—*Case* 2.

similarly, but four days later than the outer, and allowed to lie a fortnight before it was separated and wrapped round the remains of the index and middle fingers. The hand was thus freed forty-five days after the accident. The inner flap was initially made too short and it contracted somewhat, so that the terminal phalanx of the middle finger had to be removed (*Fig.* 388). The raw area on the thigh was grafted a fortnight after the hand had been freed, but owing to faulty design in the dressing the grafts did not take and healing was correspondingly delayed. About the end of June some degree of sensibility was present in the transferred skin, and at the end of July, three months after the accident and from five to seven weeks after the flaps were wrapped round, protopathic and epicritic sensibility were present over nearly all of it. The speed with which sensibility returned in this case seems to be remarkable and should prove an interesting source of more accurate inquiry in the future. No doubt much depends on the degree of integrity of the digital nerves if they are left behind by the accident; but even if they were intact, the phenomenon is not readily explicable.

At this stage a scar remained on the palm between the index and middle fingers. It was excised freely and the fingers were separated. There was not enough skin to make the covering complete. The remains of the index finger were therefore removed; in fact, it would have been better to have done this at the beginning of this particular operation. *Figs.* 389, 390 give a general idea of the present condition, and *Fig.* 391 shows the X-ray appearance. It is not proposed at this stage to operate again. The fingers are somewhat unsightly, but the nutrition is good and they do not become cold in bad weather. Partly perhaps owing to the original injury, they are still somewhat stiff, but this is improving daily. It will be interesting to see if much shrinkage occurs in the subcutaneous tissue and if the skin becomes glazed. The grasp is excellent. [Since this was written and 10 months after the injury, the top of the middle finger is conical, and may perhaps have to be removed. Shrinkage continues slowly. The skin is normal in appearance, and is becoming supple. The ring finger measures 3 inches in circumference, as compared with 2 inches for the left side.]

These two cases are of great interest and have been described in such a way as to indicate the difficulties that may occur. They show that it will generally be advisable to try to save as much as possible of fingers denuded of skin even at the risk of some degree of sepsis. While the initial injury might leave the general structure of the hand and fingers intact, except that they are devoid of covering down to the aponeurosis, it might also compress and scrape the structures, thus causing fractures, dislocations, avulsions, sprains, and other injuries. Sepsis might not only invade the pocket into which the hand is placed but might also travel up the limb. It seems to me that in most cases one would get warning of this in time to enable the process to be cut short. The patient should therefore have the chance of the parts running an aseptic course at this stage, as indeed occurred in *Case* 2. Such a course enormously reduces any after-trouble from the formation of dense scar tissue internally such as marred *Case* 1. It is clear also that placing the digits into separate pockets might limit the spread of infection. In certain

instances one finger could be freed and if necessary amputated, or an individual pocket could be treated separately without disturbing the rest of the arrangement.

Fig. 392 is a diagram of the scheme proposed for treating the whole hand, and it would be modified according to the degree of injury or the course of the case. It seems to me that lateral wrapping of skin-flaps, i.e., the 'mit' idea, is wrong except for the outer and inner fingers and for the palm of the hand—that is to say, the production of a fin or flapper as an intermediate stage is wrong. The essential thing is to make the fingers diverge from the start, and to attain this by lodging them in separate pockets, thus ensuring the other attendant advantages that have been mentioned. The only slight technical difficulty in doing this is due to the relatively large size of the proximal interphalangeal joint in the skinned middle finger. There is difficulty in pulling the digit into the tube. In the figure it will be noticed that somewhat elongated tubed-pedicle flaps have been drawn for the middle and ring fingers. This method is almost certain to be necessary in practice because the width of skin required to cover the palmar surface of each finger is $\frac{1}{2}\pi$D. The diameter at the proximal interphalangeal joint being about $\frac{3}{4}$ in., the width of the flap must be at least $1\frac{5}{28}$ in., even if only the normal amount of subcutaneous tissue were included. In practice much more than this has to be taken or the flap would not live. Schroeder (loc. cit.) suggests $\frac{1}{4}$ in. If two adjacent fingers are to be left covered before they are separated, the flap becomes so wide that it is non-viable except perhaps proximally. Subsequent writers refer to the clumsiness caused by using too thick a covering, but until the probable shrinkage coefficient is known this must continue. It is proposed to disconnect the tubed pedicles as a preliminary and separate stage to that of freeing the hand as a whole, and to open and stitch them in position either then or later. It seems that a good deal will depend on the facilities that exist at the operation for keeping the flaps warm. The adjustments and stitching are apt to take a relatively long time, and it might be most advisable to carry out this part of the operation on some kind of warm stage. The advantage of leaving behind strips of unused skin between the beds of the fingers is obvious.

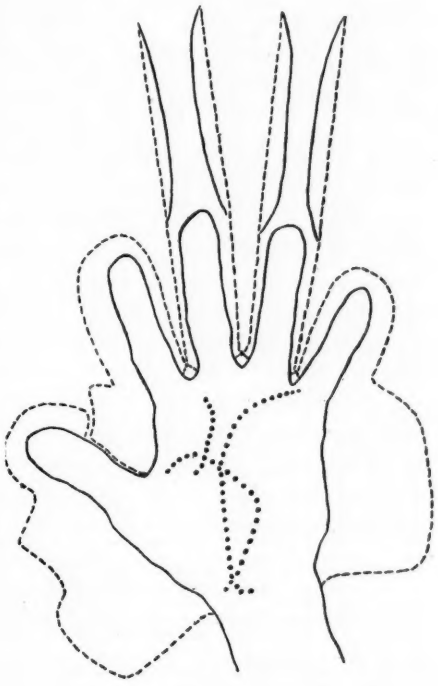


FIG. 392.—The diagram shows a scheme for covering the entire hand, back and front, with skin from the region of the hip. Some of the flaps might have to be larger according to the thickness of the subcutaneous tissue utilized. The dots indicate the possible excess or deficiency in the palm, and these would be allowed for.

In Schroeder's cases (loc. cit.) the operations were secondary ones which

were undertaken for deformity due to burns and injuries. He points out the great advantages of the double-pedicled flap in providing a covering which is mobile, elastic, and certain in taking. In McWilliams' case,[2] treated secondarily for scars following burns, " sensation had returned in the flap to about one quarter of its extent " nine months after the first operation and eight months after the hand had been released. In Foote's case[3] tactile sensation was present in part of the transplant, and pain was felt over a large area on pulling the hairs one year after operation. In Semken's case[4] sensation had returned to a considerable degree a year after operation. Two interesting questions therefore suggest themselves—namely: (1) In a secondary case are the nerves strangulated by fibrous tissue and later prevented from sprouting? (2) In a primary case, remaining aseptic and with much less strangulation, does a 'skin stimulus' to nerve growth and end-organ formation exist and cause the rapid appearance of sensibility?

No primary cases are found in *Surgery, Gynecology and Obstetrics*, Vol. I (1905) to Vol. XLII (1925), which may perhaps be taken as a criterion that the method, if it has been employed at all, has not been used often.

In *Case* 1 it might have been better to have waited a few days before inserting the hand. The immediate risk of waiting is that the fingers will die in whole or in part unless provided with a warm and nourishing covering. The secondary risk is that they will become stiff from the formation of fibrous tissue. *Case* 2 at the present time lends support to the proposal that if a reasonable chance of aseptic healing exists the operation should be undertaken as a primary one.

My house-surgeon suggested that the procedure should be termed 'cheiro-dactylo-derma-plasty'.

SUMMARY.

Two cases are described to illustrate how fingers that have been completely skinned may be saved by a primary plastic operation.

Certain technical details are given as being likely to prove useful in future cases. In these an exact examination should be made of the return of sensibility in the transplanted skin. All such cases should be published so that the chances of success may become known and the application of the method extended to cases of more extensive and deeper injuries.

I am indebted to Miss Nancy Kelly for her drawing of *Fig.* 387, and to Dr. William Brown for *Figs.* 389 and 390.

REFERENCES.

[1] SCHROEDER, *Amer. Jour. Med. Sci.*, 1900, Oct., 435.
[2] MCWILLIAMS, *Ann. of Surg.*, 1917, ii, 598.
[3] FOOTE, *Ibid.*, 1918, i, 629.
[4] SEMKEN, *Ibid.*, 1924, i, 465.

RECONSTRUCTION OF THE ANTERIOR CRUCIAL AND INTERNAL LATERAL LIGAMENTS OF THE KNEE-JOINT.

A RECORD OF ELEVEN CASES.

By MAURICE HORAN, Chepstow.

Although not a condition frequently met with in civil life, a not inconsiderable number of cases of injury to the knee-joint associated with rupture or stretching of the anterior crucial ligament have come to notice since the War, mainly the results of the violent strains of the joint to which the soldier on active service is exposed. Damage to the internal lateral ligament is invariably present. References to the condition in literature are meagre; records of results of treatment by the various methods which have been employed are scanty and lack conclusion.

A review of a series of cases in which reconstruction of the ligaments involved has been performed, and an endeavour made to follow up each case and examine the end-result, is put forward in this paper.

The series under consideration include eleven cases, all of which have been operated upon by Mr. Alwyn Smith. Eight of these have been personally observed over periods varying from six months to three years. Information regarding the remaining three has been obtained by reference to their medical documents, the patients being War Pensioners, and by a written communication from each concerning what he himself felt regarding his condition and ability to work. As they were pensioners, a certain degree of caution in the replies was not unexpected.

The method adopted in all cases has been the modification of Hey Groves' operation described by Mr. Alwyn Smith some years ago.[1] Briefly, this consists in exposure of the joint through a J-shaped incision, the long arm running down the outer side of the thigh, passing below the tubercle of the tibia, and turning up over the inner aspect of the knee. The patella is exposed, split vertically, and its halves are drawn apart. The external condyle of the femur and internal tuberosity of the tibia are now drilled in the line of the anterior crucial ligament; a strip of fascia lata 1½ in. wide is then turned down from the thigh, and drawn through the tunnel in the condyle and tibial tuberosity. The adductor tubercle is drilled subcortically, and the free end of the fascial strip is passed up through this tunnel, turned down on itself, and sutured. In this manner replacement of the anterior crucial and internal lateral ligaments is sought.

The period elapsing between the receipt of injury and the date of operative treatment, in the series under consideration, varied from one to eight years. The conditions found at operation ranged from complete rupture of both crucial, and tearing or stretching of both lateral, ligaments, as in *Case* 3, to stretching and atrophy of the anterior crucial ligament combined with

damage to the internal lateral ligament. In those cases where previous exploration had not been performed, a loose, or more generally a torn, internal meniscus was present.

Case 3 was exceptional in that both crucials and both lateral ligaments were torn; this was the only case in the series where the posterior crucial was found torn through. Instability of the joint was so marked that at times the act of walking assumed a hazardous aspect, despite the support of a knee-cage. Operation has secured for the patient a joint sufficiently stable to afford complete security in walking, although he still requires a knee-support as a provision against exaggerated movement or wrenching of the joint.

Case 7 is of considerable interest. Five years after the reconstructive operation, arthrodesis was performed in view of the *non possumus* attitude of the patient, although the joint appeared perfectly stable, even when examined under anæsthesia. The joint was excised intact, and the illustration (*see Fig.* 396) shows well the appearance of the new cord-like ligament as photographed on removal. Behind this lies the anterior crucial ligament proper, which, at the operation five years ago, had been found stretched. It had contracted up, and appeared as a firm rounded band. The specimen appears to demonstrate two facts. Recently in a paper describing a method of operation for repair of the crucial ligaments[2] it was suggested that fascia lata, separated from its source of vascularity and being a comparatively low type of tissue histologically, must degenerate and yield. It would not seem that the deduction has any very sound basis in fact. The investigations of Gallie and LeMesurier[3] show that, given an adequate supply of lymph, such fascial strips or transplants can retain their vitality independently of their vascular connections, and the specimen reproduced here affords a good illustration of this.

A second point shown by the specimen is the effect of the operation in the case of a stretched, as distinct from a torn, crucial ligament. By the assumption of the functions of the stretched ligament by the fascial substitute, and the consequent placing at rest of the damaged structure, more or less complete repair can be obtained.

CASE REPORTS.

Case 1.—N. G. W., age 33. Fell whilst jumping in 1914, a comrade falling across his knee. Admitted to hospital in July, 1926—marked anteroposterior mobility of the knee-joint, which was also mobile in the lateral direction. The tibia could be glided forwards on the femur in extension. There was a history of increasing insecurity of the joint accompanied by the knee giving way under him on making a false step, followed by his falling to the ground. Operation on July 7 by the usual method—very vascular joint, with degeneration of synovial membrane. The anterior crucial ligament was found torn; internal lateral ligament also torn. The internal semilunar cartilage was loose and fractured. The patient was discharged on Sept. 9 to continue physiotherapeutic treatment as an out-patient.

Case 2.—G. F., age 29. Buried by shell-burst in 1917, had cartilage removed in 1919. Admitted to the hospital in January, 1925, with a history of the knee giving way under him when his attention became distracted from it. Antero-posterior and lateral mobility were marked. Operation in January, 1925, by the usual method—the anterior crucial and internal lateral ligaments were found torn.

Mr. Naughton Dunn has very kindly supplied a note regarding this case, dated March 9, 1926.

" My note of November, 1924, reads as follows : 'Extreme laxity of right knee-joint suggesting complete rupture of both crucial ligaments. Knee unstable, especially in abducted position. The condition should be regarded as a more serious disability than arthrodesis.'

" I have to-day examined F. clinically. There is still some joint laxity of the knee-joint, both in the anteroposterior and lateral directions, but this is very much less marked than prior to operation. Rough grating is present in the joint suggestive of rheumatoid changes. The man can hop on the knee and bear weight on the joint in the slightly flexed position. He himself states that the knee is very much

FIG. 393.—*Case* 5. Left knee, front aspect.

better than prior to operation, but that he has not yet sufficient confidence in the joint to enable him to return to work which would involve climbing."

This patient has since returned to work, which he performs without the aid of any mechanical support.

Case 3.—J. D., age 29. Buried by explosion at a gun-pit in 1918. Admitted to hospital, January, 1925. Marked mobility in anteroposterior and lateral directions. The tibia could be readily abducted and adducted on the femur, in addition to being manipulated forwards on the femur in extension, and backwards in flexion. The patient wore a knee-cage, but complained of the utter insecurity of the joint,

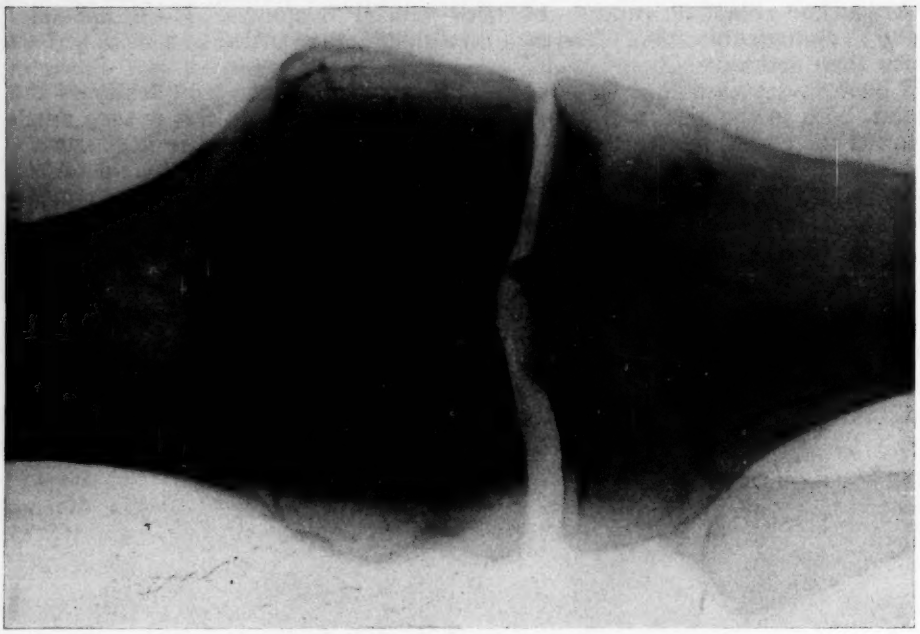


FIG. 395.—*Case* 6. Right knee, front aspect.

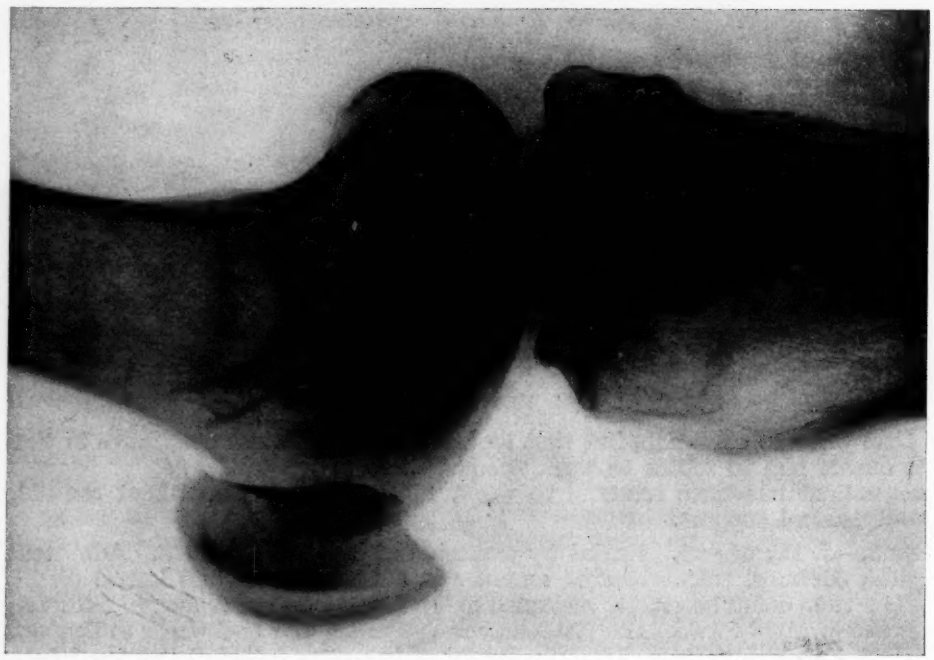


FIG. 394.—*Case* 6. Right knee, inner aspect.

involving frequent falls. Operation in January, 1925, by the usual method—both crucial ligaments found torn across; both lateral ligaments much stretched, very large fat pad, and internal meniscus loose. Second operation in July, 1925. External lateral ligament reconstructed from biceps tendon. The patient was discharged from hospital in December with a knee-cage. Some degree of mobility in both anteroposterior and lateral directions was still present; he could, however, walk quite securely without a support on level ground. He expressed himself as feeling " much more secure and not afraid to walk ".

Case 4.—J. H., age 32. Injured knee whilst playing football in 1918. The internal semilunar cartilage was removed in 1923, for pain and locking of the joint. Admitted to hospital in June, 1924, with a history of the knee giving way under him. The patient has had no locking since the former operation. Anteroposterior and lateral mobility were present. He can glide tibia forward on femur voluntarily with a peculiar jerking movement. Passively, the tibia could be manipulated forwards on the femur in full extension. Operation in June, 1924, by the usual method—anterior crucial ligament stretched and slack; internal lateral ligament torn.

Present Condition.—Movement full, no abnormal mobility. He states: " I am very pleased with the result of the operation. The whole joint seems quite secure, and I do my work of crane driver every day without any bandage or support."

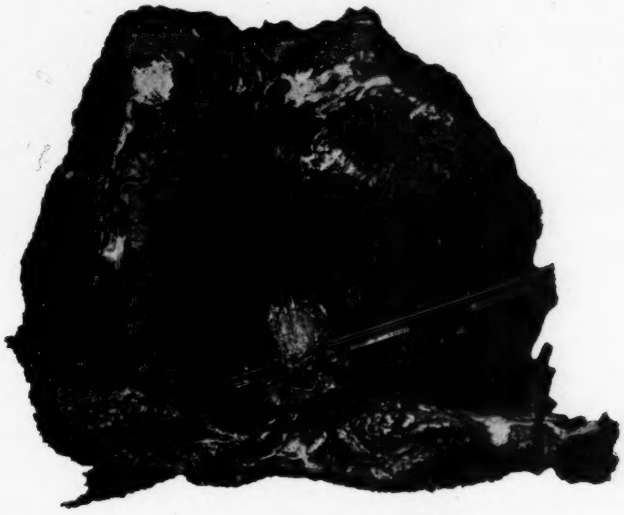


FIG. 396.—*Case* 7. Excised joint with reconstructed crucial ligament *in situ*.

Case 5.—T. G. age 33. (*Fig.* 393.) Crushed by ammunition wagon, 1915, sustaining a fracture of the lower third of the femur. Admitted to hospital in June, 1922, with a history of knee giving way. Marked abnormal mobility of joint, with tenderness over inner aspect. Flexion limited to 100°. Operation in June, 1922, by the usual method—anterior crucial ligament was found ruptured, and internal lateral ligament stretched; semilunar cartilage macerated. In this case, following discharge from hospital, the patient was supplied with a knee-cage, with subsequent deterioration. This was remedied by a course of physiotherapy, and when examined in 1925 he had developed a really remarkable musculature of both thigh and leg.

Present Condition.—No abnormal mobility, full flexion and extension. Prior to the coal strike, he was working as a collier underground.

Case 6.—T. L., age 43. (*Figs.* 394, 395.) Injury to knee whilst playing football in 1914. Operation for removal of cartilage in 1919. Admitted to hospital in June, 1920, with abnormal mobility of knee in anteroposterior and lateral directions. Much grating present on movement. Operation in July, 1920, by the usual method—anterior crucial ligament found torn. The patient was supplied with a knee-cage following discharge from hospital, but this was discarded in 1924 on instructions.

Present Condition.—Flexion to 150°; extension full. Grating present on movement, no undue anteroposterior mobility. Working as a collier underground prior to the coal strike.

Case 7.—G. R., age 42. Injury to knee in 1917. Admitted to hospital in July, 1920, with abnormal mobility of knee in anteroposterior and lateral directions.

Operation in July, 1920, by the usual method—anterior crucial ligament found stretched, and internal lateral ligament damaged; semilunar cartilage loose and torn. Following discharge from hospital, he returned to work. In November, 1923, he fell and wrenched his damaged knee. Re-admitted to hospital in 1925, complaining of weakness and insecurity of knee-joint. The joint appeared stable; no abnormal mobility in either direction; musculature good. The patient was very insistent on having a stiff knee, and arthrodesis was performed. *Fig.* 396 shows the excised joint with the reconstructed crucial ligament *in situ*.

FIG. 397.—*Case* 8. Left knee, inner view.

Case 8.—J. E. N., age 40. (*Fig.* 397.) A shell struck the bridge over which the patient was passing in 1916, his right leg slipped through a gap, and he fell forward. An operation for removal of internal semilunar cartilage was performed in 1918. He was admitted to hospital in February, 1920, with a history of the knee giving way under him on making a false step. The tibia could be manipulated forward on the femur with the joint extended; lateral mobility present. Operation in March, 1920, by the usual method—anterior crucial ligament found torn across.

Present Condition.—Full flexion and extension present, no lateral mobility. Slight degree of anteroposterior mobility present, marked grating in joint on movement. Working as collier; his chief trouble is aching in the joint, which is the seat of osteo-arthritis.

The remaining three cases have not been examined personally; the notes on each are taken from their case sheets, medical documents of the present date, the men being war pensioners, and in *Cases* 10 and 11 from personal communications received from the patients.

Case 9.—F. R., age 44. Injury to knee in 1915. Had operation for removal of cartilage in 1915. Admitted to hospital in January, 1922, with complaint of insecurity of knee-joint. Abnormal mobility present in anteroposterior and lateral directions. Operation in February, 1922, by the usual method—anterior crucial ligament found torn. Placed in plaster for two months following operation.

Present Condition (documentary).—Wears calliper. Flexion of knee limited to 90°. Thigh measures $1\frac{1}{4}$ in. less than on sound side.

Case 10.—J. P., age 30. Injury to knee in 1918 (displaced internal semilunar cartilage). Admitted to hospital in May, 1920, with unstable knee; anteroposterior mobility present. Operation in May, 1920, by the usual method—anterior crucial ligament found stretched; cartilage loose.

Present Condition (documentary).—Full movement present; slight anteroposterior mobility of joint; no wasting of thigh. Working.

Case 11.—O. P., age 38. Injury to knee in 1915. Operation for removal of cartilage in 1915. Admitted to hospital in July, 1920, with history of the knee giving way beneath him on taking a false step or walking over uneven ground. Abnormal mobility of joint in anteroposterior and lateral directions. Operation in July, 1920, by the usual method—anterior crucial ligament found torn. Immobilized for six weeks after operation.

Present Condition.—He writes: "I cannot do the work I did before I enlisted. My knee gives way after a hard day's work".

SUMMARY.

1. Reconstruction of the anterior crucial and internal lateral ligaments of the knee-joint from fascia lata has been performed in a series of eleven cases of tearing or stretching of these ligaments.

2. Examination of the results of the operation after periods varying from one to six years has been possible in ten of these; the remaining case dates from the present year.

3. The operation results in a joint capable of withstanding the stress and strain to which it is subjected in the course of ordinary and average life.

4. Early and thorough re-education of the musculature of the limb is important to success. Prolonged immobilization of the joint by splinting or plaster following operation is to be avoided, as is the mechanical support of the joint at a later period by a knee-cage or similar appliance, with the inevitable atrophy and impaired support of the musculature governing the joint.

I wish to express my gratitude to Mr. Alwyn Smith for his assistance in enabling me to examine these patients for the purpose of this paper, and for the use of the photographs; also to Mr. Naughton Dunn for kindly furnishing a note on *Case* 2. I am indebted to the Director General of the Ministry of Pensions for permission to publish the cases.

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[4] Gallie W. E., and LeMesurier, A. B., *Ibid.*, 1924, xii, 289.

A CASE OF AN INTESTINAL SAC AT THE SITE OF MECKEL'S DIVERTICULUM.

By F. JOSELIN JAUCH, London.

J. C., male, age 46, a porter, was admitted under my care at the German Hospital, Dalston, on Oct. 14, 1926, complaining of recurrent attacks of abdominal pain.

History.—Since the age of five or six the patient had experienced irregular attacks of lower abdominal discomfort, amounting occasionally to actual pain, and latterly of borborygmi, but no colic. Between the attacks he had been completely free from symptoms. Five or six years ago he had a severe attack of pain in the left iliac fossa, radiating to the right. This was followed by the formation of a swelling in the right lower quadrant which was 'dispersed' by enemata. He was confined to bed for about three weeks with fever and pain localized to the right side. Further attacks occurred ten to thirty minutes after meals for four years, and ended with repeated and copious vomiting; neither this nor food relieved the pain. There were occasional eructations of clear sour fluid accompanied by some nausea. The bowels were not usually regular, and there was a tendency to constipation. During the last three to four months he had lost about 12 lb. in weight. On two occasions he was admitted to hospital with symptoms of acute intestinal obstruction, which were relieved by enemata.

On Admission.—The patient was found to be tall but of spare build; his general condition was poor. The abdomen was tender over the right rectus near the umbilicus. No tumour was palpable. Rectal examination was negative. Radiographic examination revealed nothing abnormal.

Operation.—Under ether anæsthesia laparotomy was performed, a right paramedian incision being employed. The stomach, duodenum, gall-bladder, and colon were normal. The appendix was bound by a few adhesions and was removed. On following up these adhesions towards the left side, a swelling was revealed in the pelvis which appeared to be a dilated portion of the ileum 25¼ in. (63 cm.) from the ileocæcal valve, and was taken to be an unusual type of Meckel's diverticulum. The mesentery of this portion of intestine showed considerable thickening, obviously the result of chronic inflammation. The portion of the intestine was resected and a lateral anastomosis made. No other dilated portions of intestine or diverticula were noted. The abdomen was closed in layers.

The patient progressed favourably until the sixth day following the operation, when he suddenly developed peritonitis from a leakage of the line of suture, shown post mortem to be due to premature absorption of the catgut employed.

Description of Part Removed.—The actual 'tumour' (*Fig.* 398) appears to be a dilatation of the antimesenteric portion of the ileum, of roughly ovoid shape, with two minor accessory sacs on its distal border. The afferent portion of intestine is dilated and hypertrophied. The efferent part has a smaller

diameter than normal and is slightly thickened at its junction with the sac, where the mucous membrane has a valve-like form, admitting a pencil 6 mm. in diameter; it reminds one of the ileocæcal valve. The wall of the sac is of variable thickness, measuring from $\frac{3}{4}$ mm. to $3\frac{1}{2}$ mm. in different parts. It is most attenuated at its peripheral border. Externally it is completely covered by peritoneum, except, of course, at the mesenteric border; internally it is covered by apparently normal mucous membrane with very occasional follicles and a few rugæ typical of this part of the ileum. The middle coat is hypertrophied here and there, and the muscular strands are

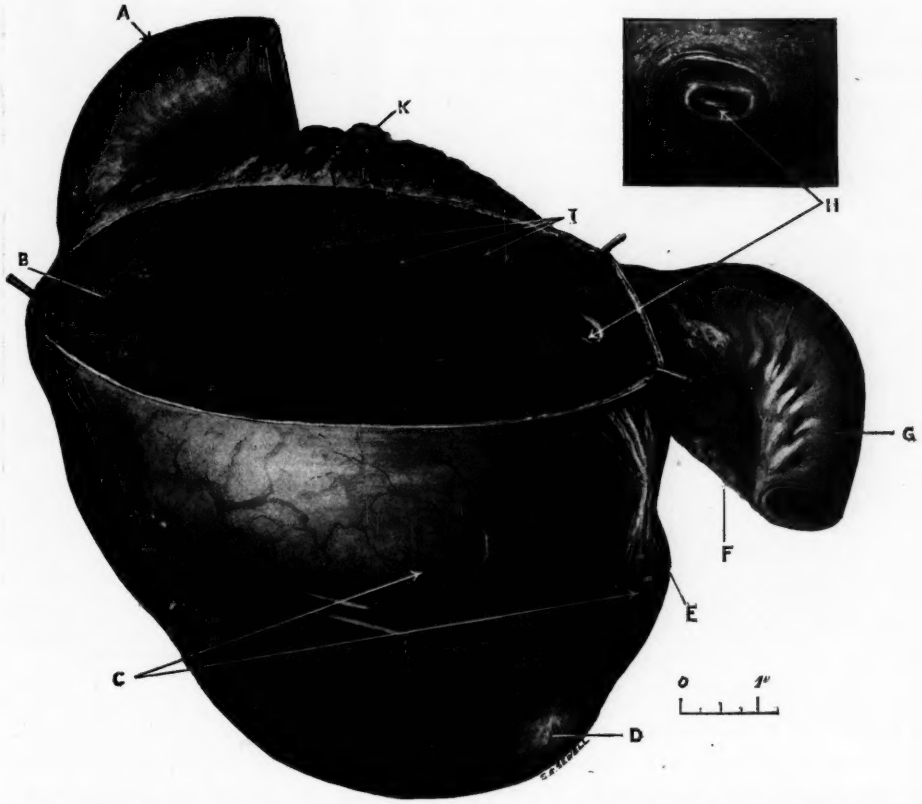

FIG. 398.—Diverticulum opened from behind. A, Afferent loop showing hypertrophy and dilatation; B, Point of entry; C, Accessory dilatations; D, Scar from previous ulceration; E, Local contraction; F Mesentery; G. Efferent loop; H, Point of exit, showing valve-like arrangement of mucous membrane, I, Dilated blood-vessels; K, Mesentery (cut short).

visibly thickened and can be seen spread over the whole of the sac. At one point on its exterior, near the distal border, there is some scarring $\frac{2}{5}$ in. (1 cm.) across, suggesting a cicatrix from previous ulceration.

The blood-vessels show moderate enlargement and are distributed over the surface of the sac. No cord was found projecting from the surface, as is the case with some varieties of Meckel's diverticulum. In the fresh state it contained intestinal contents usually found in the lower ileum. Its capacity is 845 c.c. ($1\frac{1}{2}$ pints), and at its base (mesenteric border) it measures $5\frac{1}{4}$ in.

(13·2 cm.). The longitudinal diameter is $7\frac{1}{4}$ in. (18·2 cm.), the vertical $5\frac{3}{4}$ in. (14·4 cm.), the anteroposterior $4\frac{1}{4}$ in. (10·6 cm.); the vertical circumference is $17\frac{1}{4}$ in. (43·1 cm.), and the horizontal $13\frac{1}{4}$ in. (33·1 cm.).

Histologically, the sections (*Figs.* 399, 400) show the three coats typical of the ileum. The muscular coat, both annular and longitudinal, however, is much hypertrophied in different parts, especially near the mesenteric border. The mucous membrane consists of simple tubular glands, occasionally coiled, simulating pancreatic tissue and very occasionally of the antler type, and composed of columnar cells with occasional mucus-secreting goblet cells. At no point do the glands penetrate the underlying musculature. Lymphoid tissue is but very sparsely distributed.

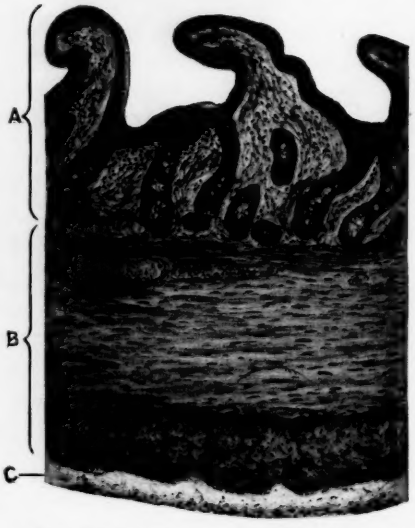

FIG. 399.—Microscopical section from the diverticulum. A, Mucous membrane; B, Muscle; C, Peritoneum.

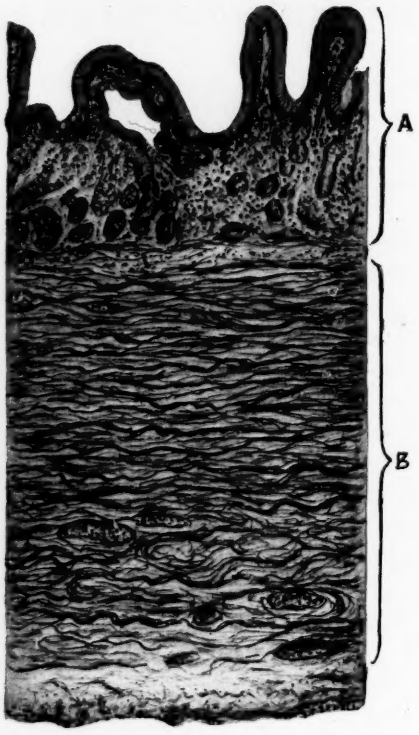

FIG 400.—Microscopical section from the diverticulum. A, Mucous membrane; B, Atrophy of muscle, with marked increase of fibrous tissue.

Microscopical examination of the appendix showed no definite abnormality. The cicatrix and adhesions in the neighbourhood of the thickened mesentery suggest a local peritonitis, which probably occurred when the patient was taken ill with fever and pain five or six years ago.

Fig. 398 shows the diverticulum opened from behind, and the distal 'valve', and *Figs.* 399 and 400 one section through the normal wall and one through the scar tissue of the sac.

The question arises as to the nature of the diverticulum. The history of discomfort early in life suggests its presence at an early period. The fact that the whole of it consists of all coats of the intestine and not a herniation of the mucous membrane proves it to be of congenital origin.

The site of a Meckel's diverticulum varies with the age of the individual, but in an adult occurs at a distance of from 1 to 4 feet from the ileocæcal

valve, most usually at about 24 in. from this point. In length it is commonly less than 4 in., the maximum length being 10 in. (Rokitansky), though a diverticulum of the small intestine 36 in. long has been described (Bilton Pollard's case). The diameter, when not represented by a fibrous cord, may be anything up to that of the ileum to which it is attached. The distal end may be free or attached to adjacent gut, mesentery, or to the umbilicus, and occasionally has small herniations. Rarely it is represented by a cyst in the wall of the gut, and may give rise to an intussusception. It is attached to the periphery of the intestine, rarely to the mesenteric border, and often has a mesentery arising from the anterior aspect of the meso-ileum. Occasionally a valve is present at its junction with the small intestine.

The shape of Meckel's diverticulum is variable; of 93 specimens studied by Sir Arthur Keith, 30 were sausage-shaped, 23 vermiform, 13 filiform, 12 saccular, 9 conical, 3 hemispherical, and 3 vestigial. Of these, 12 had secondary sacculations. The thickness of its wall is usually that of the normal ileum.

It will be seen that the diverticulum described differs from the foregoing particulars as follows: It is in the nature of a local dilatation of the long axis of the intestine, and most marked at the periphery of the latter. It is of abnormally large size, and there is the unusual presence of some stenosis at its distal end caused partly by a diminution of the peripheral measurement of the ileum here, and partly by the valve-like arrangement of the mucous membrane. The site of it agrees with that most commonly accepted for a 'Meckel'. This and the fact that stenosis is present at its distal part points to the probability of a developmental error. It is unlikely that the sac is purely the mechanical result of the stenosis; the dilatation and hypertrophy would almost certainly involve a much longer portion of small intestine, and it has been shown experimentally that pressure produces multiple diverticula, whereas this is single.

The other possibility is that the sac represents the duct plus the yolk-sac. No such instance could be found recorded in the literature. If this were the case, the yolk-sac would have been withdrawn into the cœlomic cavity during early fœtal life, and this would be supported by the fact that no cord could be traced to the umbilicus; whereas if the yolk-sac were partly represented, it ought to have a fibrous projection; this is not the case, two herniations alone being present. This view must be considered as a very unlikely probability, and it must be assumed, therefore, that the sac represents a very much dilated and hypertrophied Meckel's diverticulum.

The specimen is now preserved in the Teratological Section of the Museum of the Royal College of Surgeons.

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INTUSUSSCEPTION OF THE APPENDIX.

By G. P. B. HUDDY, Birmingham.

A male, age 39 years, was admitted to the Dudley Road Hospital, Birmingham on July 2, 1926.

History.—During the years 1918 and 1919 he had suffered from recurrent short attacks of 'stomach-ache' occurring at intervals of about six months. He was then free from symptoms until 1922, when he had an attack similar to the present one. Three weeks before admission he experienced short attacks of pain in the epigastrium and right iliac fossa, coming on particularly about one and a half hours after meals and at 2 a.m. The pain interfered with the movements of the right leg. There had been no vomiting; the bowels had been rather constipated, but neither blood nor mucus had been noticed in the stools.

On Examination.—The temperature and pulse were normal. There was tenderness in the right iliac fossa, but no rigidity and no lump. Rectal examination revealed no abnormality.

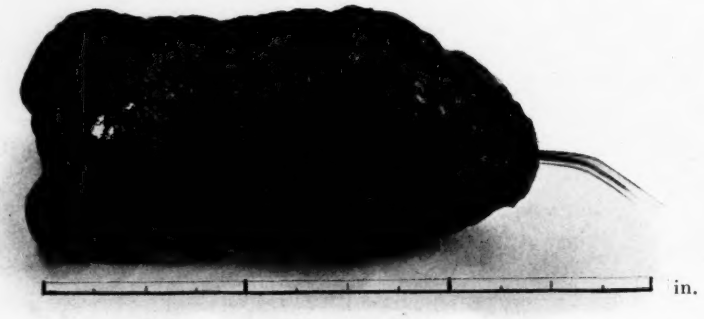

Fig. 401.—Shows probe inserted into the lumen of the appendix at the apex of the intussusception.

Operation.—The abdomen was opened through a gridiron incision. When the cæcum was delivered into the wound an elongated mass was felt within it about the size of an adult index finger, and the cæcal wall was freely movable over it. No trace of the appendix could be seen, but at the junction of the three tæniæ coli there was a small depression. A diagnosis of intussusception of the appendix was made and an attempt at reduction failed. The cæcum was opened and the projecting mass removed with a small collar of cæcal wall around it.

There were no complications during convalescence and the wound healed soundly.

The condition is illustrated in *Figs.* 401, 402. *Fig.* 401 shows the mucosal aspect, and it will be seen that the mucous membrane of the distal end is

necrotic and sharply demarcated from the healthy portion. On section there was marked muscular hypertrophy of the appendix wall.

McKidd[1] recorded a case as long ago as 1858. In 1911 Battle and Corner[2] succeeded in finding the records of 29 cases, and a specimen in the Royal College of Surgeons Museum of an unpublished case makes a total of 30. In 1922 Szenes[3] reviewed the subject very fully and found 58 examples, but he appears to have overlooked those noted by Treves,[4] Johnson,[5] and MacLennan.[6] Since the publication of his paper further cases have been recorded by Evans,[7] Hipsley,[8] Brin and Fruchaud-Brin,[9] Huese,[10] Trinci,[11] McIntosh,[12] and Do Couto.[13]

Szenes adopted the following classification :—

	Cases
1. Invagination of the appendix into itself	1
2. Total or partial invagination into the cæcum	
a. Without involvement of the cæcal wall	2
b. With involvement of the cæcal wall	17
3. Intussusception carried into the ileum, colon, or further	28
4. Cæcal invagination with commencing invagination of the appendix	2
5. Intussusception with spontaneous reduction	1

In 7 cases the description was insufficient to permit of classification.

The age incidence in the case described above is somewhat exceptional, as by far the greater number of cases arise in young children. In those occurring in older people it is not particularly common in any one decade, and may occur in old age, as in the example recorded by Brin and Fruchaud-Brin[9] in a male of 65 years. Battle and Corner[2] pointed out that the age incidence was as a rule considerably below that of appendicitis and so did not regard this latter condition as an etiological factor. Dodds Parker[14] found an ascaris in the rectum and he considered this an etiological factor. McKidd[1] noted the presence of worms in the bowel in the case he recorded, and again Hohmeier[15] attributed his case to an ascaris worm, and suggested on account of the age incidence that this might be of importance.

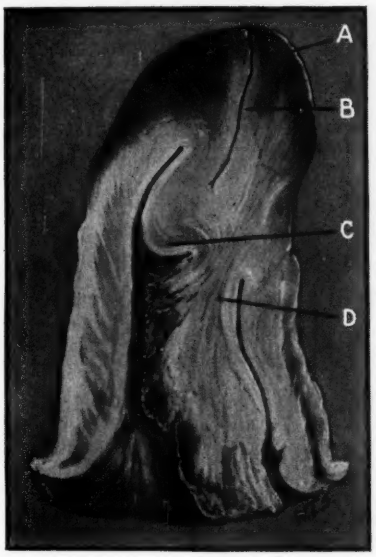

Fig. 402.—A, Necrotic tissue of apex of intussusception; B, Lumen of appendix; C, Tip of invaginated appendix; D, Meso-appendix.

Clinically there are two stages. The first is that of invagination of the appendix into itself or into the wide lumen of the cæcum, without any resulting intestinal obstruction. Later this mass acts as a foreign body and is carried forward, dragging the cæcum and later the ileo-cæcal valve into the colon. During the first stage the condition is chronic or at most subacute, and the clinical features are illustrated by the case already described. Vomiting, wasting, and the presence of blood in the stools

may also be noted. In the second stage the condition simulates the ordinary acute intussusception.

Treatment varies with the pathological condition found. In the first group, as classified by Szenes, simple appendicectomy is required. In the second group reduction of the inverted appendix usually fails, and instead of a simple appendicectomy it then becomes necessary to open the cæcum and resect the appendix with, if necessary, a collar of cæcal wall around it. If the appendix has been carried forward into the colon, this secondary condition must be dealt with on the lines of an ordinary intussusception and by manipulation converted into the second group and treated accordingly, unless on account of some complication, such as gangrene, it is necessary to resect the mass.

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CERTAIN CHEMICAL CHANGES ASSOCIATED WITH GALL-STONES, WITH SPECIAL REFERENCE TO THE RELATION BETWEEN GALL-STONES AND HYPERCHOLESTEROLÆMIA.*

By FRANK SCOTT FOWWEATHER and GEORGE ARTHUR COLLINSON, Leeds.

In spite of the very considerable volume of work which in recent years has been carried out in relation to cholelithiasis, there is still much that remains obscure with regard to this subject. The recent summary given by Wells,[1] for instance, reveals considerable diversity both of evidence and of conclusions, and leaves behind the impression that nothing is known with anything approaching certainty either of the etiology of the disease or of the mechanisms operating to produce its striking and interesting results.

Among the most intriguing of the problems presented by the study of this disease is that which concerns its relationship to hypercholesterolæmia. That considerable attention should be focused on the cholesterol content of the blood is not surprising, since cholesterol forms the greater part of nearly all gall-stones. It seems somewhat strange, however, that more attention has not been paid to the part played by calcium, since this too is present in practically all gall-stones, for even the 'pure cholesterol stone' is generally not without a trace of this element. Other problems of no less interest arise in connection with this disease, and urge the biochemist to add further investigations to those already made.

It seems to us that any investigation which makes an effort towards completeness must include within its scope not only the blood but also the bile, the stones, and the gall-bladder itself, and it is desirable to know not only how much cholesterol each contains but also how much calcium. It is with such an investigation and its results that we propose to concern ourselves in the present communication, and from our own and other workers' observations we offer certain suggestions bearing on some of the problems of this disease.

COLLECTION AND PREPARATION OF THE MATERIAL.

The material used throughout this investigation has been obtained from patients under the care of Sir Berkeley Moynihan. Specimens of blood were obtained within a day or two prior to operation, and, in certain cases to be described later, at an interval of six to twelve months after operation. The

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* From the Clinic of Sir Berkeley Moynihan.

rest of the material consisted of the gall-bladders, with the contained bile and stones, which were removed at operation. These were placed under sterile conditions into sterilized receptacles, and sent as soon as possible to the laboratory, where they were opened and the gall-bladder and its contents separated. Specimens from the gall-bladder wall and from the bile were reserved for bacteriological examination, while from the remainder portions were used for chemical analysis, the stones also being used for the same purpose. The preparation of these materials for chemical analysis was as follows :—

Gall-bladder.—Boyd,[2] in his interesting work on the gall-bladder, stripped the mucous membrane from the rest of the organ and used this for his observations. In many of our cases changes in the mucous membrane by long-standing disease rendered its separation impossible, and it was considered advisable, in order to have uniform conditions throughout, to take the whole thickness of the gall-bladder wall for analysis, removing only fatty deposits and adventitious tissue. Any bile adhering to it was removed by washing in cold running water, after which the tissue was dried quickly on filter-paper but not pressed. Two portions from the same part of the gall-bladder, each about one inch square, were removed and separately weighed. One portion was at once used for cholesterol estimation, and the other was dried to constant weight in the steam oven, after which it was used for calcium estimation. By means of the drying process data were obtained which enabled us to calculate all results as a percentage of *dry tissue* present, thus eliminating the disturbing effects on the results due to a widely different water content of different specimens.

Bile.—Immediately after removal of the bile from the gall-bladder it was centrifugalized to remove suspended material, and the clear supernatant fluid used for analysis. In cases where the bile was too viscid for satisfactory centrifugalization or accurate measurement of small quantities, it was first diluted in bulk in a known ratio with distilled water, and the clear diluted liquid used for analysis.

Stones.—These were thoroughly washed in cold running water, dried with filter paper, and preserved in cotton-wool to be analysed when convenient.

METHODS OF ANALYSIS.

1. **Estimation of Cholesterol.**—

a. In Blood.—For this estimation we have employed the method of Myers and Wardell,[3] using standard solutions of pure cholesterol in chloroform for colorimetric comparison. By this method 'total' cholesterol is estimated—i.e., both free cholesterol and cholesterol present as esters.

b. In Tissue.—The piece of tissue selected for analysis was cut up into very small pieces and thoroughly ground with 3 to 4 grm. of plaster-of-Paris in a glass mortar. The mixture was then dried and extracted as in Myers and Wardell's method for blood.

c. In Bile.—The essential features of the method used for blood were retained, but a modification had to be introduced owing to the fact that the pigments of heated bile are soluble in chloroform, so that their presence in the chloroform extract renders the colour developed from the cholesterol unsuitable for satisfactory comparison. The pigments can be fixed as sodium salts, which are insoluble in chloroform, by the addition of a little caustic soda. Accordingly a measured quantity of bile was mixed with an equal volume of dilute (approximately normal) caustic soda solution, and the determination of cholesterol was made on 1 c.c. of this mixture, by the method used for blood.

d. In Stones.—The stones were finely powdered and extracted in a modified Soxhlet apparatus with chloroform. The solvent was evaporated from the extract, and the amount of cholesterol determined by direct weighing of the residue. Strictly speaking, the residue does not consist wholly of cholesterol, but the amount of other chloroform-soluble substances in gall-stones is relatively so small as to leave our results sufficiently accurate for our present purpose.

2. Estimation of Calcium.—

a. In Blood.—For this purpose we have employed the method of Kramer and Tisdall,[4] using plasma obtained from blood to which a little solid sodium citrate had been added.

b. In Tissue.—The tissue selected for analysis was thoroughly dried in the steam oven and the proportion of dry matter present was determined. The dry tissue, in a small porcelain crucible, was then carefully ignited, using a blow-pipe if necessary to remove all traces of carbon. After cooling, any white residue which had adhered to the sides of the crucible was washed down with a very fine jet of water from a wash-bottle. The total washings were not allowed to exceed 2 c.c.; 0·5 c.c. of hydrochloric acid (1–3) was then added, and the crucible allowed to stand for a few minutes to permit of complete solution of the calcium salts of the residue. A drop of litmus solution was then added, and strong ammonia solution from a teat pipette, a drop at a time, until the liquid became alkaline. This liquid was then washed into a 10-c.c. graduated centrifuge tube until the total volume was about 6 c.c. From this point onward the estimation was proceeded with as in the case of blood-plasma.

c. In Bile.—For this estimation the method used for blood was followed, with one modification. It was found that the addition to bile of ammonium oxalate caused the precipitation of some organic matter, oxidizable by permanganate, in addition to calcium oxalate. This organic matter is not soluble in dilute sulphuric acid. Hence, after dissolving the calcium oxalate precipitate in the acid, the residue of organic matter was collected at the bottom of a centrifuge tube by centrifugalization and the supernatant fluid removed from it by decantation, before being titrated with permanganate. By this method results were obtained which agreed well with those given by the sound but laborious method of ignition.

d. In Stones.—The method employed was similar to that described for tissue, namely, the ignition of a weighed quantity of the powdered stone with

solution of the residue in hydrochloric acid and determination of the calcium in solution by means of permanganate.

Normal Standards.—The normal range for cholesterol and calcium in the blood has been already established. In order to obtain values for these substances in the bile and gall-bladder wall we selected material from the post-mortem room from healthy subjects who had died suddenly as the result of street accidents, and on whom the post-mortem examination was made within three or four hours after death. Only material from persons who in the pathologist's opinion were quite healthy at the time of the accident was accepted. The limitations imposed made the number of suitable cases very small, but the results obtained lie within such narrow limits that they probably form a sufficiently satisfactory standard for comparison with those obtained from pathological cases, many of which differed very considerably from the standards obtained. The results are shown in *Table I.*

Table I.—**NORMAL GALL-BLADDERS.**

Post-mortem Number	Calcium in G.-B. Wall		Cholesterol in G.-B. Wall		Bile	
	Wet	Dry	Wet	Dry	Calcium	Cholesterol
	Mgrm. per 100 grm.	Mgrm. per 100 grm.	Per cent	Per cent	Mgrm. per 100 c.c.	Per cent
211–25	30·5	153	0·206	1·03	21·0	0·21
212–25	23·0	117	0·194	0·97	20·0	0·20
378–25	27·0	109	0·193	0·77	—	—
814–25	31·0	140	0·190	0·85	14·2	0·24
140–26	26·0	101	0·200	0·79	19·2	0·28
152–26	23·0	118	0·200	1·07	—	—
339–26	20·5	104	0·180	0·91	27·0	0·23
Range ..	20·5 to 30·5	101 to 153	0·180 to 0·206	0·77 to 1·07	14·2 to 27	0·20 to 0·28
Mean ..	25	120	0·195	0·91	20	0·23

RESULTS IN 81 CASES OF CHOLECYSTECTOMY.

In drawing up our results in these cases we have introduced signs to indicate at once to the reader the significance of the result obtained—whether normal, increased, or diminished—instead of actual figures. The range obtained and the mean with respect to each set of figures is given in each section of *Table II.* The table has been subdivided into sections according to the type of result obtained for the blood cholesterol, as this seems to be the best way of indicating the relationship between blood-cholesterol findings

and other changes which were found to accompany the presence of gall-stones. The meaning of the signs employed is as follows :—

Blood	Calcium (mgrm. per 100 c.c.)	Cholesterol (per cent)
N = Normal	9–11	0·13–0·16
N+ = High normal	11–11·5	0·16–0·19
+ = Raised	Over 11·5	0·20–0·24
++ = Very high	—	Over 0·24
N− = Low normal	8·6–9	0·11–0·13
− = Diminished	Less than 8·6	—

Gall-bladder Wall	Calcium (mgrm. per 100 grm. dry tissue)	Cholesterol (percentage dry tissue)
N	100–120	0·90–1·05
N+	120–160	1·05–1·10
+	160–200	1·10–1·30
++	Over 200	Over 1·30
N−	70–100	0·80–0·90
−	Less than 70	Less than 0·80

Bile	Calcium (mgrm. per 100 c.c.)	Cholesterol (per cent)
N	18–28	0·19–0·22
N+	28–35	0·22–0·30
+	Over 35	0·30–0·35
++	—	Over 0·35
N−	12–18	0·15–0·19
−	Less than 12	Less than 0·15

The last column of the table contains data regarding the stones found in the gall-bladder. The results of bacteriological examination of bile and gall-bladder wall are also given, together with any special information noted regarding the condition of the gall-bladder. Brief notes of the patient's history have also been added. In the different sections of the table we have separated from the rest those cases in which, owing to complete occlusion of the cystic duct, 'white bile' has been produced, since, so far as the composition of the gall-bladder fluid is concerned, these must necessarily differ from those cases in which the bile reservoir has not been cut off from its source of supply.

It was not possible to obtain analytical data for every member of the system in every case. In some instances, for example, the quantity of bile present in the gall-bladder was insufficient for analysis. In the majority of cases, however, full data have been obtained.

Table II.—**RESULTS IN 81 CASES OF CHOLECYSTECTOMY.**

A. **Blood-cholesterol** ++ = 0·246 per cent to 0·499 per cent.
Mean = 0·296 per cent.

Number, Age & Sex	Cholesterol		Calcium			Remarks
	G.B.	Bile	Blood	G.B.	Bile	
Cases with pigmented bile—						
4 69–M	N	..	N	++	..	One large stone filling a shrivelled bladder. Calcium 3·24 per cent, cholesterol 78 per cent; *copper present* in stone. Jaundice at operation. Long history
7 59–F	..	N	..	++	N−	No stones. Bile and gall-bladder sterile. Frequent attacks; 3 years' history.
11 44–M	−	..	+	N	..	Two mulberry stones. Calcium 0·03 per cent, cholesterol 91 per cent. Also 7 small stones. Bile and bladder sterile. 4 attacks in 2½ years
12 64–M	++	..	+	N+	..	Six small stones. Calcium 1·0 per cent, cholesterol 68 per cent, and *race of copper*. Small shrunken bladder. Bile and bladder —*B. coli*. 2 years' history
41 53–F	+	+	N	+	N	One large stone. Calcium 3·6 per cent, cholesterol 61 per cent. Bile and gall-bladder sterile. Short history
53 42–F	N+	−	+	++	−	Nine large faceted stones. Calcium trace, cholesterol 81 per cent. Bladder large and distended. Bile and bladder—*B. coli*. 1 year's history
55 41–F	++	++	N	++	N	No stones. Adhesions round gall-bladder. Gastro-enterostomy 3½ years ago
59 ?–F	N	++	N	N−	−	No stones. Strawberry gall-bladder, much inflamed. Bile and bladder sterile. Stone removed 3 years ago, followed by recurrence of symptoms.
62 ?–F	++	N+	+	+	N	No stones. Bladder very fatty. Bile and bladder sterile. Long history of frequent attacks
69 45–F	++	..	−	N	..	One large pigmented stone and one small faceted. Calcium 0·9 per cent, cholesterol 68 per cent. Jaundice at operation. Bile and bladder—*B. coli*. Short history; frequent attacks
	Per cent	Per cent	Mg. per 100 c.c.	Mg. per 100 g.	Mg. per 100 c.c.	
Range	0·72 to 2·48	0·12 to 0·54	8·1 to 13·1	80 to 309	9·2 to 24·1	
Mean	1·42	0·32	10·8	183	15·4	

Number, Age & Sex	Cholesterol		Calcium			Remarks
	G.B.	Bile	Blood	G.B.	Bile	
Summary of 10 cases with pigmented bile—						
++	4	2	..	4	..	
+	1	1	4	2	..	
N+	1	2	..	1	..	
N	2	..	4	2	3	
N−	..	..	..	1	1	
—	1	1	1	..	2	
Not determined	1	4	1	..	4	
Cases with 'white bile'—						
24 56–F	N+	—	..	+	—	No stones in bladder. Bile sterile. Bladder —*B. coli* and staphylococcus. Frequent attacks; short history
72 ?–F	—	..	N+	—	..	Many stones. Calcium trace, cholesterol 83 per cent. Bile and bladder—*B. coli*. Long history.
73 46–F	—	—	+	N	—	Many stones. Calcium 0·6 per cent, cholesterol 70 per cent. Bladder inflamed. Bile and bladder "pure growth of a coccobacillus with tendency to form bizarre bacillary forms". 2 years' history
	Per cent	Per cent	Mg. per 100 c.c.	Mg. per 100 g.	Mg. per 100 c.c.	
Range	0·57 to 1·13	trace to 0·07	11.4 to 13·1	40 to 194	6 to 10	
Mean	0·83	..	12·2	115	8	
Summary of 3 cases with 'white bile'—						
++	..	..	..	..	..	
+	..	..	1	1	..	
N+	1	..	1	..	..	
N	..	..	..	1	..	
N−	..	..	..	..	..	
—	2	2	..	1	2	
Not determined	..	1	1	..	..	

B. **Blood-cholesterol** + = 0·195 per cent to 0·240 per cent.
Mean = 0·213 per cent.

Number, Age & Sex	Cholesterol		Calcium			Remarks
	G.B.	Bile	Blood	G.B.	Bile	
Cases with pigmented bile—						
1 58–F	+	—	..	++	N—	One large stone. Calcium 8·6 per cent, cholesterol 51 per cent. Many smaller stones. Calcium 2·2 per cent, cholesterol 72 per cent. Bladder thickened. Bile and bladder—*B. coli*. 4 years' history
6 48–F	N	++	N—	+	N	One stone. Calcium 0·2 per cent, cholesterol 78 per cent. Bile and bladder sterile. Indefinite history over long period
8 ?–F	++	N—	..	++	N—	Many small stones. Calcium 0·4 per cent, cholesterol 76 per cent. Bile and bladder—*B. coli*. Bladder inflamed. 3 years' history
13 52–F	—	++	—	N+	N	No stones, much sandy sediment. Bile and bladder—*B. coli*. Long history; previous drainage of gall-bladder
16 64–M	—	..	+	N+	..	No stones, some sandy sediment. Bladder small and shrunken. Bile and bladder sterile. Short history. Jaundice at operation
29 44–F	—	++	+	—	—	No stones. Bile sterile. Bladder—*St. albus*. Bladder adherent. Short history
30 50–F	N	++	N	—	N—	Two large stones. Calcium 0·03 per cent, cholesterol 90 per cent. Bile and bladder sterile. Long history
36 27–F	N	N+	+	+	N	One large stone. Calcium trace, cholesterol 94 per cent. Bile and bladder sterile. Short history
46 81–M	N—	N+	N	N	N—	Three round and many faceted stones. Calcium 0·9 per cent, cholesterol 71 per cent. Bile and bladder sterile. Bladder thickened and scarred
50 53–F	+	N+	+	N+	..	No stones. Bile and bladder—*B. coli*. Bladder lying in mass of adhesions. 2 years' history; recent severe attack
56 51–F	++	N	..	N+	N	Stone in cystic duct. Bile and bladder sterile. Bladder surrounded by adhesions. Short history; recent attack
57 45–F	N	N—	N	N+	N	Many stones. Calcium 11 per cent, cholesterol 40 per cent. Bile and bladder—non-hæmolytic streptococcus probably of fæcal type. Long history
60 54–M	N—	++	N	+	N	One large stone. Calcium 2·1 per cent, cholesterol 76 per cent. Bile and bladder sterile. Bladder adherent to duodenum. Long history
61 ?–F	+	N+	N—	N	N	Twenty-five small black stones. Calcium 12 per cent, cholesterol 54 per cent. Bile and bladder sterile. Long history
63 43–F	++	..	N	N—	..	Many small stones. Calcium 0·3 per cent, cholesterol 78 per cent. Bile and bladder —non-hæmolytic streptococcus. Bladder small and thickened. Long history
66 ?–F	+	++	+	N	..	One stone. Calcium 0·1 per cent, cholesterol 84 per cent. Bile sterile. Bladder—one isolated colony of *St. aureus*. Typhoid 5 years ago

Number, Age & Sex	Cholesterol		Calcium			Remarks
	G.B.	Bile	Blood	G.B.	Bile	
	Per cent	Per cent	Mg. per 100 c.c.	Mg. per 100 g.	Mg. per 100 c.c.	
Range	0·62 to 1·51	0·11 to 1·0	8·6 to 13·1	40 to 289	10·6 to 24·0	
Mean	1·03	0·36	10·9	137	18·5	
Summary of 16 cases with pigmented bile—						
++	3	6	..	2	..	
+	4	..	5	3	..	
N+	..	4	..	5	..	
N	4	1	5	3	7	
N−	2	2	2	1	4	
−	3	1	..	2	1	
Not determined	..	2	4	..	4	
Cases with 'white bile'—						
14 44–M	N	−	..	N−	N−	One small stone. Calcium 0·5 per cent, cholesterol 76 per cent. Bile sterile. Bladder—one colony of *St. albus*. Stone in cystic duct. Short history
25 50–F	−	−	N	N	−	One stone. Calcium trace, cholesterol 84 per cent. Bile and bladder—*St. aureus*. Previous operation, leaving fistula to skin
34 30–F	+	−	N	N+	−	Two large and 7 small stones. Calcium 2 per cent, cholesterol 73 per cent. Bile sterile. Bladder—a few colonies of a diphtheroid bacillus. 5 years' history
45 ?–F	−	−	+	+	N−	Seven stones. Calcium 0·1 per cent, cholesterol 63 per cent. Bile and bladder sterile. 8 years' history
54 ?–M	N+	−	N	N+	−	Twenty-two small black stones. Calcium 16 per cent, cholesterol 6 per cent. Bile—profuse growth of *B. coli* and few colonies of non-hæmolytic streptococci. Bladder—*B. coli*. Long history
68 ?–M	−	−	N+	N+	N−	One large stone impacted in cystic duct. Calcium 4·6 per cent, cholesterol 48 per cent. Bile and bladder sterile. Long history
	Per cent	Per cent	Mg. per 100 c.c.	Mg. per 100 g.	Mg. per 100 c.c.	
Range	0·33 to 1·29	0·05 to 0·13	10·2 to 11·6	98 to 181	2·8 to 15·0	
Mean	0·79	0·08	10·96	136	10·3	
Summary of 6 cases with 'white bile'—						
++	..	..	..	..	..	
+	1	..	1	1	..	
N+	1	..	1	3	..	
N	1	..	3	1	..	
N−	..	..	..	1	3	
−	3	6	..	..	3	
Not determined	..	..	1	..	..	

C. **Blood-cholesterol** N+ = 0·162 per cent to 0·190 per cent.
Mean = 0·179 per cent.

Number, Age & Sex	Cholesterol		Calcium			Remarks
	G.B.	Bile	Blood	G.B.	Bile	
5 61–F	++	++	..	++	N	One large stone in which some *cotton fibres* were embedded. Calcium 6·4 per cent, cholesterol 46 per cent. Bile and bladder sterile.
15 35–F	++	N+	N	N+	—	About 100 hard black stones. Calcium 33·4 per cent, cholesterol 1·4 per cent. Bile and bladder sterile. 1 year's history; frequent attacks
21 45–M	..	..	N	++	..	Many stones—not analysed. Bile—numerous colonies of *St. aureus*. Bladder—*St. aureus* and a hæmolytic non-fæcal streptococcus. Jaundice at operation. Short history
22 55–F	—	++	+	++	N—	Thirty-four fairly large stones. Calcium 1·2 per cent, cholesterol 71 per cent. Bile and bladder—*St. albus*. 2 to 3 years' history
28 33–F	—	..	N	++	..	Single mulberry stone. Calcium 0·1 per cent, cholesterol 94 per cent. Bladder small and shrunken, with surrounding adhesions. Bile and bladder sterile. Indefinite, long history
51 59–F	++	..	N	++	..	Single stone. Calcium 2·5 per cent, cholesterol 63 per cent. Bile and bladder—*B. typhosus*. Indefinite, long history
65 43–M	—	..	N	N—	..	No stones. Bile—a few colonies of *St. albus*. Bladder sterile. At operation large duodenal ulcer found with many adhesions burying the gall-bladder. Long history
67 ?–M	—	++	N+	—	N—	Numerous small stones. Calcium trace, cholesterol 80 per cent. Bile and bladder sterile. Long history
	Per cent	Per cent	Mg. per 100 c.c.	Mg. per 100 g.	Mg. per 100 c.c.	
Range	0·45 to 1·45	0·25 to 0·46	9·5 to 13·2	60 to 330	12·2 to 22·4	
Mean	0·94	0·38	10·9	185	15·9	
Summary—						
++	3	3	..	5	..	
+	..	..	1	..	..	
N+	..	1	1	1	..	
N	..	..	5	..	1	
N—	..	..	..	1	2	
—	4	..	..	1	1	
Not determined	1	4	1	..	4	

D. **Blood-cholesterol** N = 0·130 to 0·160.
Mean = 0·144.

Number, Age & Sex	Cholesterol		Calcium			Remarks
	G.B.	Bile	Blood	G.B.	Bile	
9 60–F	N	N+	+	N+	N	Single stone. Calcium 1·4 per cent, cholesterol 76 per cent. Bile and bladder—fæcal streptococci. Cholecystotomy 8 years ago
10 46–F	+	++	..	+	N−	Nine small stones. Calcium 0·2 per cent, cholesterol 91 per cent. Bile and bladder sterile. Very recent history
17 50–F	N−	+	N	N+	N−	No stones, some sediment. Bile and bladder sterile. 1½ years' history; frequent attacks
18 32–F	N	++	+	++	N	Three large mulberry stones. Calcium 0·12 per cent, cholesterol 87 per cent. Bladder sterile. Bile not examined. 8 years' history
19 67–M	N−	..	+	++	..	One stone in common duct—not analysed. Bladder—*B. coli* and a non-hæmolytic fæcal streptococcus. Bile not examined. Bladder dry and shrunken. Long history
20 37–M	N	N	..	+	N−	Many small stones. Calcium 0·05 per cent, cholesterol 89 per cent. Bile and bladder sterile. Short history
23 59–M	−	..	+	+	..	Three large and 9 smaller stones. Calcium 1·9 per cent, cholesterol 30 per cent, and *trace of copper*. Bile and bladder—*B. coli* and non-hæmolytic streptococci. Small bladder with fistula into colon. Long history
27 52–M	N	++	N	N+	+	Two enormous stones. Calcium 2·1 per cent, cholesterol 60 per cent. Bile and bladder sterile. 8 years' history
31 60–M	−	N+	..	N+	N−	Five large and many small stones. Calcium trace, cholesterol 85 per cent. Bile and bladder sterile. Bladder fibrosed. 1 year's history
32 65–M	++	N	+	N	N−	Ten small stones. Calcium trace, cholesterol 91 per cent. Bladder large and inflamed
33 60–M	+	..	N	N+	..	One large stone. Calcium 0·5 per cent, cholesterol 76 per cent. Bile and bladder—non-hæmolytic streptococci. Bladder thickened, with ulceration. Long history
37 44–F	+	N+	N	N+	−	No stones. Bile and bladder sterile. Bladder adherent to duodenum, Long, indefinite history
38 41–F	N−	N+	+	N	−	Ten small stones. Calcium 0·1 per cent, cholesterol 81 per cent. Bile and bladder sterile. Long, indefinite history
39 60–F	++	+	N	++	N	One stone. Calcium 7·3 per cent, cholesterol 43 per cent, and some sandy sediment. Bile and bladder sterile. Bladder thickened. 2 years' history
40 60–F	N	N−	N	N	..	Two small black stones. Calcium 1·2 per cent, cholesterol 68 per cent. Bile and bladder—*B. coli*. Bladder small, fibrosed. Operation for gall-stones 10 years ago
43 42–F	++	++	N	N	+	Many small stones. Calcium trace, cholesterol 80 per cent. Bile and bladder sterile. Slight lipoid stippling of mucosa. 3 years' history

Number, Age & Sex	Cholesterol		Calcium			Remarks
	G.B.	Bile	Blood	G.B.	Bile	
44 42–F	N−	++	N	++	+	Thirty-eight small stones. Calcium 3 per cent, cholesterol 63 per cent. Bile and bladder sterile. Bladder inflamed. Indefinite history for 2½ years
47 32–F	N−	..	N+	++	..	Fifty small stones. Calcium 0·04 per cent, cholesterol 74 per cent. 5½ years' history
49 39–F	++	N−	N	+	−	Twenty small stones. Calcium 16 per cent, cholesterol 6 per cent. Bile and bladder—*B. coli*. Bladder mucosa atrophic and granular
58 55–M	++	N−	..	..	N−	Nine fairly large and 30 smaller stones. Calcium 0·1 per cent, cholesterol 82 per cent. Bile and bladder sterile. 3 years' history
64 41–F	−	..	N	−	..	No stones. Bile and bladder—*B. coli*. Bladder small, white, adherent. 2 years' history
75 52–M	−	..	N+	++	..	Single stone. Calcium 25·0 per cent, cholesterol 9 per cent. Bladder much fibrosed
76 60–M	−	..	N	N	..	Single stone. Calcium 0·5 per cent, cholesterol 86 per cent. Bladder inflamed
78 57–F	++	N+	..	−	N−	No stones. Lipoid deposits in bladder wall
79 53–F	++	++	N	N	N−	One large stone. Bile and bladder sterile
81 31–F	N	..	..	N+	..	No stones. Bile and bladder sterile
	Per cent	Per cent	Mg. per 100 c.c.	Mg. per 100 g.	Mg. per 100 c.c.	
Range	0·47 to 4·43	0·15 to 1·79	9·1 to 13·2	33 to 339	10·3 to 43·0	
Mean	1·22	0·43	10·9	159	18·5	
Summary of cases with pigmented bile—						
++	7	6	..	6	..	
+	3	2	6	4	3	
N+	..	5	2	7	..	
N	6	2	12	6	3	
N−	5	3	..	..	8	
−	5	..	..	2	3	
Not determined	..	8	6	1	9	
Cases with 'white bile'—						
26 62–M	N+	−	+	N−	−	One large stone with 3 distinct layers, viz.: core, calcium 0·6 per cent, cholesterol 82 per cent; middle, calcium 2·6 per cent, cholesterol 56 per cent; outer, calcium 0·2 per cent, cholesterol 85 per cent. Bile and bladder—*B. coli*
35 54–F	−	..	N	−	..	One large stone. Calcium 0·15 per cent, cholesterol 88 per cent. One smaller stone. Bile—*B. coli*. Bladder sterile. 1 year's history
	Per cent	Per cent	Mg. per 100 c.c.	Mg. per 100 g.	Mg. per 100 c.c.	
Range	0·50 to 1·10	trace to 9·2	9·2 to 13·8	72 to 80	trace	

E. **Blood-cholesterol** N− = 0·111 per cent to 0·120 per cent.
Mean = 0·118 per cent.

Number, Age & Sex	Cholesterol		Calcium			Remarks
	G.B.	Bile	Blood	G.B.	Bile	
42 60–M	−	N	N	N+	N−	No stones. Some black gritty deposit. Bile—*B. coli*. Bladder—*B. coli*, a few colonies of *St. albus*. Long indefinite history
71 47–F	−	N+	..	N+	N−	Many small black stones. Calcium 11 per cent, cholesterol 40 per cent. Bile and bladder sterile. Bladder thickened. Long, indefinite history
74 49–F	++	..	..	+	..	Two stones. Calcium 9·8 per cent, cholesterol 40 per cent. Bile and bladder sterile. 1 year's history
80 33–F	N−	N+	..	N−	..	Single small stone. Calcium trace, cholesterol 80 per cent. Bile and bladder sterile
	Per cent	Per cent	Mg. per 100 c.c.	Mg. per 100 g.	Mg. per 100 c.c.	
Range	0·71 to 3·61	0·21 to 0·28	10·8	133 to 170	17 to 18	
Mean	1·47	0·25	—	134	17·5	
	Summary—					
++	1	..	..	..	..	
+	..	..	..	1	..	
N+	..	2	..	2	..	
N	..	1	1	..	..	
N−	1	..	..	1	2	
−	2	..	..	..	..	
Not determined	..	1	1	..	2	

F. **Blood-cholesterol** not determined.

Number, Age & Sex	Cholesterol		Calcium			Remarks
	G.B.	Bile	Blood	G.P.	Bile	
2 ?–F	..	N	..	+	−	No stones. Bladder adherent. Long, indefinite history
3 44–F	+	++	..	+	N	Seventeen stones. Calcium 5·5 per cent, cholesterol 79 per cent. Bladder inflamed. Long, indefinite history
48 ?–F	N−	..	..	++	..	Single stone with calcareous cap. Calcium 35 per cent, cholesterol 15 per cent. Bile and bladder sterile. 2 years' history
52 ?–F	++	++	..	++	N	Two small stones. Calcium 6 per cent, cholesterol 49 per cent. Bile and bladder sterile. Recent history
70 28–F	+	N	..	N+	N−	About 100 small stones. Calcium trace, cholesterol 90 per cent. Bile and bladder sterile. Wall thickened. Recent history
77 45–F	+	−	..	N+	..	Many stones. Calcium 2·6 per cent, cholesterol 45 per cent

It is necessary to bear in mind, when considering the foregoing results, that a perfectly clear-cut picture of the processes at work in the formation of gall-stones is not to be expected. Some patients come for operation after one or a few attacks, and with a comparatively short history. The gall-bladders in such cases are frequently found to show comparatively little change and are probably capable of comparatively normal function. On the other hand, as a result of frequent or severe attacks, or the long-continued presence of stones in the gall-bladder, this organ is sometimes found to consist of little but fibrous tissue whose function must be considerably impaired or almost non-existent. The results obtained by us in such cases, in which one member of the system is not functioning in the normal way, will clearly differ from those in which all members are active, and will differ from the results which would have been obtained in the earlier stages of the disease in these same cases. Further, the history, the indications of the ages of the stones (as shown by the number of separate 'families' or the number of distinct laminæ in individual stones), and the histological examination of the gall-bladder, cannot give us more than a rough idea of the functional capacity of the organ concerned, since neither duration of disease nor apparent structural change bears a close relationship to failure of function. If these limitations are borne in mind, it does seem possible to observe certain definite tendencies from the results shown, and from these to infer what processes are at work. Before considering the results in detail, certain more general information offered by *Table II* may be referred to.

Sex Incidence.—Out of 81 patients 24 (29·6 per cent) were males.

Demonstrable Infection of Bile and Gall-bladder Wall.—Out of 66 cases in which both bile and gall-bladder wall were examined bacteriologically, the findings were as follows :—

Bile and gall-bladder	Negative	38
" " "	*B. coli*	11
" " "	Non-hæmolytic streptococci	4
" " "	*St. aureus*	1
" " "	*St. albus*	1
" " "	*B. typhosus*	1
" " "	Rare coccobacillus	1
Bile, negative; Gall-bladder, *St. albus*		2
" " " *St. aureus*		1
" " " Diphtheroid bacillus		1
" " " *B. coli* and staphylococci		1
Gall-bladder, negative; Bile, *St. albus*		1
Bile, *B. coli*; Gall-bladder, *B.coli* and *St. albus*		1
" *B. coli* and non-hæmolytic streptococci; Gall-bladder, *B. coli*		1
" *St. aureus*; Gall-bladder, *St. aureus* and hæmolytic streptococci		1

Blood Changes.—Of 75 cases in which the blood cholesterol was determined, 35 (46·7 per cent) had definitely raised values, while 8 (10·7 per cent) had high normal values. Only 4 had low normal values, and no case gave values less than 0·11 per cent.

Out of 58 cases in which the blood calcium was determined, 19 (32·8 per cent) had definitely raised values, while 5 (8·6 per cent) had high normal values. Two only had low normal values, while one had a definitely low

value, this being a case in which jaundice was present when the specimen was taken for analysis. Low blood-calcium values are to be expected when jaundice is present, since the bilirubin in the blood probably reacts with some of the calcium present to form the calcium salt of bilirubin, which is insoluble and hence is not present in the plasma used for analysis.

Eleven of the 19 cases with raised blood-calcium occurred amongst the 35 cases with raised blood-cholesterol, while the remaining 8 occurred amongst 36 cases with normal or high normal blood-cholesterol. There is, then, so far as the present series of cases is concerned, a somewhat greater tendency for the blood-calcium to be raised where the cholesterol is also high than where the cholesterol is normal.

Bile Changes.—For reasons already mentioned, cases with 'white bile' require to be considered separately from those with true, pigmented bile. So far as cholesterol content is concerned, of 9 cases of 'white bile' examined, all showed a definitely low value, as would be expected. Of 50 cases of pigmented bile, the following summary indicates the findings :—

Cholesterol	No. of Cases	Percentage of Total	
++	19	38	44
+	3	6	
N+	14	28	50
N	6	12	
N−	5	10	
−	3	6	

That is, experimental evidence shows undoubtedly that in cases of gall-stones the most frequent variation from the normal in the cholesterol content of the bile, where complete obstruction of the cystic duct is absent, is towards an increased cholesterol concentration.

Turning now to calcium, we find that, of 9 cases of 'white bile' examined, 3 gave low normal, and 6 definitely low values; while in 45 cases of true pigmented bile the results were as follows :—

Calcium	No. of Cases	Percentage of Total
+	3	6·7
N	16	35·5
N−	18	40·0
−	8	17·8

That is, the most frequent variation from the normal is a reduction in calcium concentration.

Changes in the Gall-bladder Wall.—Out of 11 cases with 'white bile', the gall-bladder cholesterol was raised in 1 case, high normal in 3, and definitely low in 6. In 66 cases with pigmented bile, the results were as follows :—

Cholesterol	No. of Cases	Percentage of Total	
++	19	28·8	45·5
+	11	16·7	
N+	1	1·5	31·8
N	12	18·2	
N−	8	12·1	
−	15	22·7	

This table shows 45·5 per cent of cases with definitely raised values and 22·7 per cent with definitely low values, i.e., in cases of gall-stones a very considerable proportion show changes in the cholesterol content of the gall-bladder, and where complete obstruction of the cystic duct is absent there is a greater tendency for increase in cholesterol concentration than for decrease.

When we consider calcium, we find, in the 11 'white bile' cases, 2 with raised values, 2 with lowered values, and 7 within the normal range, whereas in 69 cases with pigmented bile the distribution is :—

Calcium	No. of Cases	Percentage of Total	
++	19	27·5	44·9
+	12	17·4	
N+	18	26·1	47·8
N	11	15·9	
N−	4	5·8	
−	5		7·3

This shows 44·9 per cent of cases with definitely raised values and 7·3 per cent with definitely reduced values ; i.e., in cases of gall-stones a large proportion show definite changes in the calcium content of the gall-bladder wall, and where complete obstruction of the cystic duct is absent the number which show increase is considerably in excess of those which show a decrease.

When we come to consider the different sections of the table separately, the outstanding fact is that in nearly all cases considerable disturbance is found in the composition either of the gall-bladder or of the bile, or of both, and moreover there is no obvious preponderance of such disturbance in any one section of the table ; i.e., in patients with gall-stones, apart from any changes that may be found in the blood cholesterol, there are frequently noticeable changes in the composition of the gall-bladder wall and the bile. That is to say, there is some association between the formation of gall-stones and changes in the chemical composition of the gall-bladder and the bile.

The way in which the different constituents dealt with vary with the blood cholesterol is shown in *Fig.* 403, in which the mean value of the different constituents in each section of *Table II* is plotted against the mean of the blood-cholesterol values for the same section. (Section *E* is not included in this figure, since the results obtained in this section are too few to be of any significance.) The chart shows clearly that even where the blood cholesterol is normal, there are, in general, marked changes in both the bile and the gall-bladder. Further, it shows that changes in the bile calcium are accompanied by changes in the gall-bladder calcium in the opposite direction, and the same reciprocal relationship obtains between the bile cholesterol and the gall-bladder cholesterol for cases with a definitely raised blood cholesterol, though this reciprocal relationship is not in evidence where the blood cholesterol is within fairly normal limits.

An examination of the results of our analyses of the stones obtained from the different cases shows that in each section of the table stones of widely varying composition are found, and there is no very obvious preponderance of any single type of stone in any section of the table. The 'solitary cholesterol gall-stone' is seen to be accompanied by chemical changes in

blood, gall-bladder, and bile quite similar to changes accompanying other types of stones, so that, on chemical grounds, it has no claim to be considered as a distinct and separate entity.

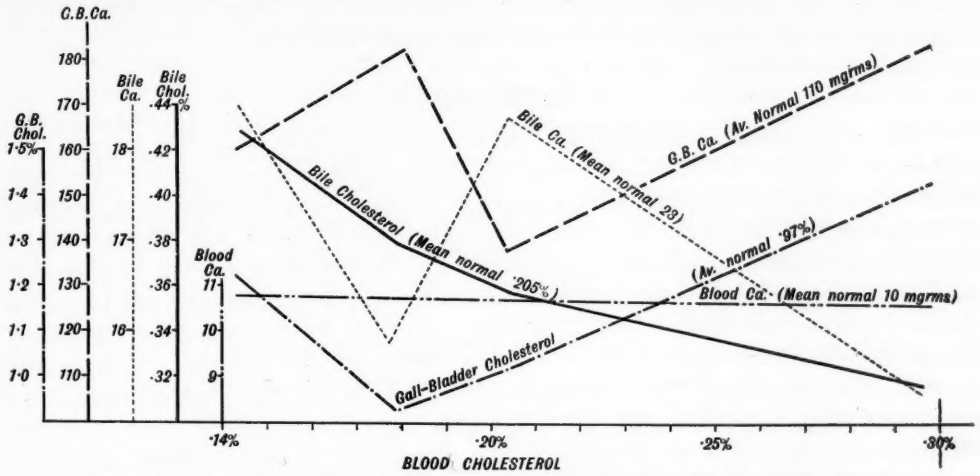

FIG. 403.—Chart showing relation between changes in the gall-bladder-wall and bile and those in the blood cholesterol.

Thus the results of our stone analyses afford us no assistance in the general consideration of our subject. They assume interest, however, when considered with the blood, bile, and gall-bladder findings of individual cases.

Before proceeding to a discussion of the significance of our experimental results, it may be advisable to summarize the indications already obtained.

SUMMARY OF RESULTS.

1. *Blood cholesterol.*—46·7 per cent of cases showed definitely raised values for blood cholesterol.

2. *Blood calcium.*—32·8 per cent of cases showed definitely raised values for blood calcium.

3. *Bile cholesterol.*—44 per cent of cases showed a definitely increased concentration of cholesterol, as against only 6 per cent with a decreased concentration. The mean value throughout was considerably higher than the mean normal value, but decreased with increase in the blood cholesterol.

4. *Bile calcium.*—17·8 per cent of cases showed a definitely decreased calcium concentration, as against 6·7 per cent with increased concentration. The mean value throughout was below the normal mean value, but its variation with increased blood cholesterol was not always in the same direction.

5. *Gall-bladder cholesterol.*—45·5 per cent of cases showed a definitely raised cholesterol concentration, 22·7 per cent a lowered concentration.

6. *Gall-bladder calcium.*—44·9 per cent of cases showed a definitely increased calcium concentration, as against only 7·3 per cent having a decreased concentration. The mean values throughout were definitely above the mean normal value, but the variations with the blood cholesterol were not always in the same direction. These variations are, however, in the opposite direction to those of the bile calcium.

7. The great majority of cases, whatever the value for blood cholesterol, showed marked changes in the chemical composition either of the gall-bladder or bile or both.

8. No particular type of stone was found to be associated with any special type of chemical change in the other materials examined.

DISCUSSION.

The experimental results just quoted clearly show that the presence of gall-stones is very frequently associated with considerable changes in the gall-bladder and the bile, and, moreover, that hypercholesterolæmia is a frequent accompaniment of such changes. Hitherto, apart from the deposition of cholesterol, calcium, and bile pigments in the formation of stones, this change in blood cholesterol has been the outstanding chemical change noted in connection with cholelithiasis, and there has naturally been a tendency to regard it not merely as an event, but as a causal factor, in the disease. It is a well-known fact, however, that diabetics, who, owing to diet restrictions, eat a comparatively large amount of foods rich in cholesterol, develop a hypercholesterolæmia which is frequently of a degree much higher than that found in patients with gall-stones, yet we are not aware that these diabetics have a correspondingly increased tendency to develop gall-stones. Moreover, if a constitutional tendency to hypercholesterolæmia were a cause of gall-stones, there is no reason to believe that mere removal of the site of stone formation —the gall-bladder—should remove this tendency—i.e., hypercholesterolæmia should persist after removal of the gall-bladder. In order to test this hypothesis we have made blood-cholesterol determinations in a number of cases in which the gall-bladder had been removed some months before. The results are shown in *Table III.*

Table III.—**EFFECT OF CHOLECYSTECTOMY ON THE BLOOD CHOLESTEROL.**

Case No.	Date of Operation (1925). Blood Specimen a few Hours Previously	Blood Cholesterol	Date of Second Blood Specimen (1926)	Blood Cholesterol
		per cent		per cent
7	Feb. 17	0·272	June 4	0·121
12	March 20	0·290	June 4	0·188
13	March 20	0·215	June 7	0·190
15	March 26	0·180	June 14	0·155
18	April 3	0·140	June 7	0·150
22	April 17	0·185	June 7	0·140
24	April 24	0·250	June 7	0·155
29	May 20	0·213	June 7	0·160
43	July 31	0·135	June 3	0·145
44	July 31	0·160	June 4	0·120
56	Oct. 16	0·210	June 4	0·160

It will be seen that, where the blood cholesterol was higher than normal before operation, the removal of the gall-bladder has been followed by a marked decrease in blood cholesterol to within normal limits. Where the blood cholesterol was normal before operation the effect of cholecystectomy was negligible. This decrease in blood-cholesterol cannot be attributed to dietetic measures, for all the patients were of the hospital class who are notoriously averse to strict dietetic control over a considerable period, and all stated that they had resumed their normal diet. It is clear, therefore, that the hypercholesterolæmia associated with gall-stones is closely bound up with the gall-bladder and its contents. Hence, any inquiry into the cause of gall-stone formation must be directed to the gall-bladder itself, and a satisfactory theory must account for the chemical changes in the gall-bladder wall and bile which we have noted, and for the tendency to hypercholesterolæmia. If we account at the same time for an increased cholesterol content of the blood, gall-bladder, and bile, together with the formation of solid deposits of cholesterol within the gall-bladder, then we must also account for an increased total amount of cholesterol within the body. We have already suggested that increased intake of cholesterol does not of itself account for the formation of gall-stones, though it explains the production of a hypercholesterolæmia. If we examine the possibility of a diminished loss of cholesterol from the body, such a condition, taken into consideration with certain functions now known to be carried on by the gall-bladder, offers a logical and coherent explanation of all the facts brought out by our experimental work.

Loss of cholesterol occurs in the fæces. In a recent paper[5] one of us (F. S. F.) has shown that the average amount of 'unsaponifiable matter' (which consists mainly of sterols) present in the fat of the fæces amounts to nearly 2 per cent of the total dry matter of the fæces. A diminution of this loss, resulting from a diminution in the flow of gall-bladder bile into the intestine, would account for an increase in the total amount of cholesterol retained in the body. The functions of the gall-bladder which must be considered along with this retention of cholesterol are : (1) The gall-bladder is an organ in which bile is concentrated to a considerable degree ; and (2) The gall-bladder absorbs cholesterol, and probably many other substances. The first of these has been clearly shown by Rous and McMaster[6], and is now very generally recognized. The second is indicated in the work of Boyd and also of Torinoumi.[7] Boyd also describes experiments showing that the gall-bladder can absorb iron, and quotes experiments on dogs by Harer, Hargis, and Van Meter[8] which suggest not only that the gall-bladder possesses ready powers of absorption, but that the absorbed material passes into the lymphatics.

If we assume that there is some degree of obstruction to the outflow of gall-bladder bile into the intestine, while the inflow of dilute bile from the liver is maintained, we have, in the presence of a continual process of concentration, a normal rate of addition of cholesterol (and other substances) together with a diminished loss, which must result in the production of a bile of greater concentration than normal. At the same time we have a gall-bladder which normally absorbs cholesterol now in contact with a fluid richer than usual in this substance, so that the amount of cholesterol passing through

the gall-bladder and into the circulation will also be increased. Here, then, we have an explanation of the tendency to increased concentration of cholesterol in blood, gall-bladder, and bile. Further, a continuance of the process of concentration of the bile will ultimately result in the production of a bile which is saturated with respect to cholesterol, and any further concentration beyond this point will result in the deposition of solid cholesterol from the overcharged solution, i.e., we shall get the formation of stones. The assumption we have made would appear therefore to account, in the main, for our experimental findings with respect to the changes found to accompany gall-stones, at any rate so far as cholesterol is concerned. We shall return later to a consideration of the part played by calcium.

In looking for a cause which should bring into operation the process we have outlined, our attention is at once drawn to inflammatory processes. Moynihan, Hurst, and others have so clearly shown the connection between cholecystitis and cholelithiasis that we do not intend to bring forth any arguments to prove this relationship. What concerns us is how cholecystitis may be responsible for an increased concentration of the bile by the processes we have suggested. A diminished outflow of bile from the gall-bladder can be conceived as resulting from an involvement of the cystic duct in the inflammatory processes, whereby the mucosa becomes swollen, with consequent narrowing of the lumen. Such a condition of the duct would undoubtedly result in considerably less obstruction to the inflow of the dilute liver bile than to the outflow of the more viscid gall-bladder bile, especially as the viscosity of the latter is further added to by an increased supply of mucus as a result of the inflammatory process.

In addition to inflammatory processes it appears necessary to take into account the possibility that alteration of the mechanical conditions within the abdomen may, by interfering with the normal outflow of bile into the intestine, also result in the processes we have outlined in a certain proportion of cases. Thus the profound mechanical disturbance resulting from the presence of the continually enlarging uterus of pregnancy may, along these lines, explain the hypercholesterolæmia which has been shown to be associated with that condition, and the relatively large incidence of gall-stones in women who have borne children.

Having outlined the processes involved in gall-stone formation, together with their probable cause, we propose to discuss certain matters in greater detail.

Boyd's evidence shows that the formation of deposits of cholesterol ester in the mucosa of the gall-bladder is an important feature in many cases of early cholecystitis, while it appears in the fibrosa at a much later stage. Our own experimental results show that considerable increase of cholesterol in bile and gall-bladder may be present, along with a normal blood-cholesterol (*see Fig.* 403), thus suggesting that the first stage is a deposition of cholesterol in the gall-bladder mucosa, along with, and probably on account of, increased bile concentration, and that subsequently the increased cholesterol of the gall-bladder results in the passage of increased amounts of cholesterol into the blood-stream, i.e., increased bile concentration precedes increased cholesterol absorption—a finding in agreement with our theory. Further, the

great variation possible in the degree of restriction of the outflow of bile from the gall-bladder accounts for the well-known variation in the rate at which gall-stones may be formed. While the rate at which solids are deposited from the bile will depend on the rate and degree of its concentration, their formation will also depend on the presence of suitable nuclei for crystallization. In the absence of a suitable nucleus lying free in the gall-bladder, supersaturation of the bile to a very considerable degree may occur before crystallization results, and, during this period of supersaturation, deposition of cholesterol in the gall-bladder mucosa will be taking place. Then, to quote Boyd again, " as this deposit of lipoid increases in bulk, the villus in which it is contained may develop more and more into a papillomatous-like process, the stalk of which finally becomes so attenuated that separation is inevitable. When that occurs we have a foreign body composed of cholesterol and albuminous material lying in the cavity of the gall-bladder and forming an ideal nucleus for the formation of further deposits". Such conditions account for the strawberry gall-bladder as a state preceding stone formation. Once there is a suitable nucleus, crystallization around it will take place rapidly or slowly according to the degree of supersaturation of the enveloping bile. Moreover, if crystallization of a substance takes place rapidly from a solution supersaturated by that substance, the crystals will be fairly pure and contain little of other materials present in the solution—hence the 'pure cholesterol stone'. If, however, a suitable nucleus is originally present, we may not get a high degree of supersaturation with subsequent rapid crystallization, but crystallization around the nucleus will begin to occur immediately the concentration of the bile exceeds the saturation value, and will proceed comparatively slowly. Under such conditions the stone will contain, besides the substance in which the solution is supersaturated, considerable amounts of other materials present in the solution. In this connection it is interesting to note that in the four cases in which we have demonstrated the presence of foreign material in the stones, namely three (*Cases* 4, 12, and 23) with copper, and one (*Case* 5) with cotton fibres, the stones contained an appreciable quantity (1·0 to 6·4 per cent) of calcium, compared with 0·1 per cent or less in the 'pure cholesterol' stones.

So far we have only considered the part played by cholesterol. When we turn our attention to calcium, we find similar results with regard to the blood and gall-bladder, but a difference in the bile. Corresponding to the tendency to hypercholesterolæmia, our experimental results have shown a tendency to hypercalcæmia. It is not necessary that the tendency to each should be of the same degree, since there is no reason to assume that the absorptive power of the gall-bladder should be the same for different substances. Further, the concentration of calcium in the bile is of a different order from that of cholesterol, the normal value for the latter being about 200 mgrm. per 100 c.c., while that of the former is only about 20 mgrm. per 100 c.c. The gall-bladder shows the same change with respect to calcium as it does to cholesterol, namely, an increased concentration; but, whereas the cholesterol content of the bile is frequently increased, its calcium content is very rarely exceeded, but on the contrary tends to be reduced. These findings are confirmed by Lichtwitz and Bock,[9] who failed to find any increase in calcium in the bile from an inflamed gall-bladder. This fact at first sight would appear to

contradict our view that concentration of the bile is the cause of stone formation, unless at the same time we take into consideration the changes in the gall-bladder calcium. The average figure throughout our series for the calcium in the gall-bladder is approximately 160 mgrm. per 100 grm. compared with a normal value of 110 mgrm., i.e., there is on the average an increase of 50 mgrm. per 100 grm. ; whereas the average figure for calcium in the bile is about 17 mgrm. per 100 c.c. compared with a normal of 23 mgrm., i.e., a decrease of only 6 mgrm. per 100 c.c. There is on the whole, then, a concentration of calcium, but, as a result of this concentration, deposition of calcium occurs in the gall-bladder without the appearance of increased calcium in the bile. The form of the curves in *Fig.* 403 for calcium in gall-bladder and bile offers strong support to the view that low calcium content of bile is not due to lack of concentration but to deposition in the gall-bladder.

We are not able to offer a precise explanation for this failure to attain a high calcium content in the bile, but certain possibilities suggest themselves. The blood calcium is 9 to 11 mgrm. per 100 c.c., and blood is normally near its saturation point with respect to calcium. The bile calcium is approximately double this quantity, and is believed to be kept in solution by the cholesterol and the bile salts present in the bile. It may be that the solution of calcium in normal bile is already in an unstable condition, with a constant tendency to deposition, but with the normal flow of fluid through the gall-bladder actual deposition there does not occur. Any stasis occurring with respect to gall-bladder bile will favour the deposition of calcium, and hence the production of a reduced bile-calcium concentration. If this view is correct, then the theory we have suggested to account for gall-stone production and its attendant phenomena receives support and not contradiction from the observed tendency to decreased calcium concentration of the bile, since the theory necessarily implies some degree of stasis of gall-bladder bile. Experimental confirmation of this view is suggested by the work of Drury.[10] He found that gall-stones frequently formed in dogs intubated for the collection of bile under sterile conditions. The stones consisted almost entirely of calcium carbonate and calcium bilirubinate. He also made a day-to-day study of the sediment of the sterile liver bile of intubated dogs, and found a marked tendency to deposition of calcium carbonate therefrom. A further point in favour of the view that there is a constant tendency for the bile to deposit calcium (which tendency will be increased by the presence of an appropriate nucleus) is seen in the fact that all gall-stones not of recent origin are found to be surrounded by a shell rich in calcium salts, chiefly the carbonate.

With regard to the question as to why calcium carbonate predominates in some cases and calcium bilirubinate in others, we are again unable to offer any evidence of our own. Wells quotes evidence suggesting that the presence of the positively charged protein substances from inflammatory exudates leads to the precipitation of calcium bilirubinate (which is electro-negative) from bile, and hence the formation of pigment calculi is favoured or initiated by inflammation of the biliary tracts. On this view the amount of calcium bilirubinate found will have some relation to the degree and extent of the inflammatory processes occurring, and will vary in different cases—a result amply confirmed by experience.

If the deposition of calcium (in either form) occurs before crystallization of cholesterol, a nucleus around which the cholesterol can be deposited will be present. We shall thus get a type of stone which is, in fact, very frequently found, namely, the cholesterol stone with a calcium-containing nucleus.

We have so far shown how, starting with a partial obstruction to the outflow of bile into the intestine, due no doubt in most cases to an inflammatory process in the gall-bladder, there results an increased concentration of the bile contained therein, with an accompanying tendency to hypercholesterolæmia and hypercalcæmia, and how, under the conditions so produced, the different varieties of gall-stones may be formed. If a patient suffering from cholecystitis comes for examination during the active stage of the disease, we ought to find hypercholesterolæmia and possibly hypercalcæmia; but in view of the fact that a disturbance of the blood calcium seems more difficult to produce than a disturbance of the blood cholesterol, the former will not be so frequently found as the latter. In addition, we should find a bile with high cholesterol concentration and normal or reduced calcium concentration and a gall-bladder containing an increased amount of both substances.

We may or we may not find stones. *Cases* 55 and 62, for example, represent such a state of affairs without stones, and *Cases* 12 and 41 give similar findings with stones also present. The proportion of cases which come for examination and treatment during an early attack is, however, small. In many cases the inflammation subsides, with a consequent tendency for all concentrations to return to normal. It does not follow, however, that all return to normal at the same rate or reach normal values in the same time. The type of result obtained subsequent to an attack may therefore present many variations between the typical cases quoted and the strictly normal. Infection, however, is often periodic. Subsequent attacks may occur with a repetition of the former processes, which, however, may be modified by changes in structure, composition, and function of the gall-bladder, produced either by a former inflammatory process or as a result of the presence of stones formed in an earlier attack. The findings in such cases, too, will be altered in one or more particulars from those of the typical cases quoted. Our own series is obviously a mixture of early and late cases, and this accounts for the great variation in the results obtained.

A few words remain to be said concerning 'white bile'. Our experimental findings regarding this fluid agree with those of other workers, namely, that it has lost, or is in the process of losing, practically all its cholesterol and calcium. That this is not due simply to deposition of these substances in the gall-bladder is shown by the fact that in these cases the gall-bladder cholesterol and calcium are not uniformly increased. The results support the view that both calcium and cholesterol are absorbed by the gall-bladder and passed on to the blood-stream. Our results show that 'white bile' may coexist with either raised or normal blood cholesterol and calcium. This does not appear to us to be contrary to the view we have already expressed that high blood cholesterol and calcium are primarily due to concentration of the bile. Occlusion of the cystic duct and consequent cutting off from the gall-bladder of further supplies of liver bile will undoubtedly mean the

beginning of the end so far as high blood cholesterol and calcium are concerned; but it is quite conceivable that the production of 'white bile' may be a more rapid process than the return of a high blood cholesterol or calcium to a normal level. Consequently the finding of raised or normal blood values will depend on the time which has elapsed between the occlusion of the cystic duct and the examination of the blood.

The views we have expressed represent to us a logical explanation, consistent with known chemical facts, of the many phenomena associated with cholelithiasis, and, moreover, do not appear to overstrain the probabilities as demonstrated by our own work or that of the majority of other workers in this field. In particular they appear to offer a more satisfactory explanation of the relation of this condition to hypercholesterolæmia. They suggest that hypercholesterolæmia is typically present in the acute stages of disease responsible for gall-stone formation, and that it disappears with the passing of this acute attack. Its diagnostic value is not that it indicates the presence of gall-stones or cholecystitis, but that it indicates a present or recent attack of the disease, and its indication is further strengthened if accompanied by high blood calcium. Our views consequently show how gall-stones may be found without an accompanying hypercholesterolæmia, and suggest that apparently varying and contradictory findings of different workers with respect to hypercholesterolæmia in cholelithiasis may simply be due to the fact that examinations have been made in different stages of the disease.

We are well aware that the idea of bile stasis as a factor in gall-stone formation has often been suggested. While our work was not undertaken with the object of supporting this or any other view, but simply to try to obtain further information respecting cholelithiasis, our results have forced us to the view we have outlined, and, we believe, have shown how the stasis we have suggested is linked up with the other changes which are found in this interesting condition.

In conclusion we wish to express our very deep indebtedness to Sir Berkeley Moynihan, at whose suggestion this work was undertaken. He has throughout shown the greatest interest in its progress, and moreover has supplied us with all our material. We are also indebted to Dr. Elaine Knowles, who has collected the clinical notes of our cases, and to our colleagues on the staff of the bacteriological department of the University for carrying out the bacteriological examinations of gall-bladder and bile.

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INTRATHORACIC NEW GROWTHS: AN ACCOUNT OF SEVEN OPERABLE CASES.

By A. TUDOR EDWARDS, London.

Thoracic surgery has made very great strides in the last twenty years, and not only have certain difficulties as regards the effects of freely opening the pleura been overcome, but definite advances have been made in our methods of diagnosis. Intrathoracic growths have been regarded in the past as comparatively rare, but either they have increased considerably in number during the last ten years, or else methods, especially X-ray, have made a definite diagnosis in cases which previously were overlooked or misdiagnosed.

At present malignant disease arising in the chest—mediastinum, pleura, or lung—unfortunately rarely offers any hope of radical operation. This results from two factors: the first, that as a rule it commences insidiously, and until extension to surrounding structures, such as pleura or bronchi, occurs there are no localizing symptoms, the general symptoms of lassitude and loss of weight alone being present. Therefore at the time when diagnosis is possible the growth is too extensive for any radical operation. The second factor is the site of origin of malignant disease. In the vast majority of cases the start is in the mediastinum in close relationship with vital organs or the structures in the hilum of the lung, where it would entail, at least, complete unilateral pneumectomy before there could be any hope of eradicating the disease.

There are, however, two types of malignant disease which offer reasonable hope of radical treatment: (1) Localized endothelioma of the pleura; and (2) The so-called alveolar carcinoma—as the latter arises in the neighbourhood of the middle of the lobe. *Case* 5 in the following reports was taken at operation to be of the latter type, but proved histologically to be an endothelioma arising, it would appear, in the lower lobe. In an experience of about forty cases of malignant disease of the lungs and mediastinum this was the only one which offered any hope of complete operative removal, although many others were explored and abandoned after removal of a portion for histological examination.

METHODS OF DIAGNOSIS.

Apart from the usual clinical examination which is always made, there are certain very valuable further examinations which should never be neglected.

X Rays.—This method has proved invaluable. Greater precision is being rapidly attained as experience becomes wider, for the study of radiograms and the screen examination of the chest offer great initial difficulty in their interpretation. In addition to the accepted anteroposterior and postero-anterior examinations, true lateral and oblique skiagrams offer considerable

assistance in diagnosis. Further X-ray examinations should be made after the induction of artificial pneumothorax or the intratracheal instillation of lipiodol.

Artificial Pneumothorax.—The introduction of oxygen or other gases into the pleural cavity, where pleural adhesions do not prevent the establishment of pneumothorax, is often of much help in the elucidation of the relationship of tumours to the lung (see *Case* 1). The amount required generally is about 1500 c.c. of gas introduced on two or three separate occasions, followed by radiography.

Thoracoscopy.—The visual demonstration of the tumour by means of the thoracoscope can often be of value, giving a further indication of the relationship of lung and tumour or of the attachments and surface appearance of the tumour. This was done on three occasions (*Cases* 1, 3, 7), but was impossible in the others owing to inability to establish a pneumothorax.

Lipiodol Injection.—The intratracheal instillation of lipiodol will map out the bronchial tree in a subsequent skiagram, which should include lateral as well as anteroposterior views. Its value has not been so marked in this series, but should prove of use in some cases, especially where partial obstruction of the bronchus occurs as a result of the presence of small intrabronchial tumours.

Bronchoscopy.—In a certain proportion of cases bronchoscopic examination is essential, and especially in those where evidence of bronchial obstruction, with signs of early bronchiectasis, is present.

Œsophageal Examination.—Where preliminary X-ray examination shows a shadow of presumptive tumour in the mediastinal area, the administration of barium with subsequent radiological examination of its passage through the œsophagus will often disclose important relationships. Further, œsophagoscopy will in certain cases show displacement or bulging, or even actual ulceration into the lumen of the œsophagus.

In this paper it is not proposed to discuss the differential diagnosis of the various types of tumours or review the previous literature; it is published with a view to demonstrating the possibility of successful removal of at any rate the benign tumours arising within the thoracic cavity, and to show that, in much rarer cases, malignant growths of certain types, and arising in certain positions, can be completely and successfully eradicated.

In the majority of cases it is difficult to decide before operation whether the growths are benign or malignant, and even in the early stages of exploration their nature may be in doubt (see *Case* 4). This raises a point which requires considerable emphasis—namely, that intrathoracic tumours, after full examination by all known methods, should always be submitted to an exploratory thoracotomy, and that, even when exposed, and appearances suggestive of malignancy—hard nodulations—are present, they should always be explored by: (1) Aspiration through a large-bore needle; and (2) Actual incision into the growth and the removal of a portion for microscopical examination.

Benign growths eventually destroy life by increase of size and pressure on vital organs; but before this the patient is often a chronic invalid for several years, and the earlier these tumours are removed the easier the

operation and the greater the certainty of complete recovery. Lastly, a fairly large proportion of the growths are either of a mild malignant nature—fibro-chondro-sarcomata, which do not commonly recur if removed completely and widely at an early stage, or teratomata, which are essentially liable to undergo malignant changes; there are three cases of these in this series. These results—the liability to destroy by direct pressure on vital structures and to undergo malignant change—are strong indications for operation as soon as possible after diagnosis of the presence of tumour.

CASE REPORTS.

Case 1.—**Chondrosarcoma of the 2nd, 3rd, and 4th ribs. Intrathoracic removal: recovery.**

E. M., female, age 57, admitted to the Brompton Hospital under Dr. Nelson on Dec. 3, 1923.

HISTORY.—The patient had always enjoyed good health until four to five months previously, when she had a severe cold. Two months before admission she developed a bad cough, with pain in the upper right chest. There was slight loss of weight and a very slight amount of sputum, which was negative for tubercle bacilli on two examinations.

ON EXAMINATION.—There was dullness over the upper part of the right chest, with diminished breath-sounds and expiration prolonged; vocal resonance and fremitus were absent. The signs were present anteriorly and posteriorly.

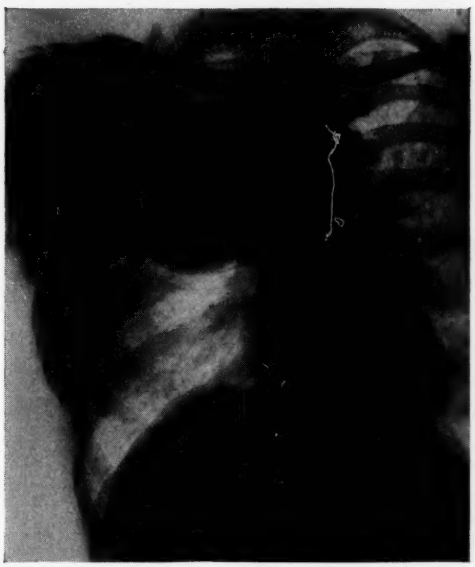

FIG. 404.—*Case* 1. Skiagram of chondro-sarcoma in upper right thoracic cavity. Small black ring has been placed there for stereoscopic purposes.

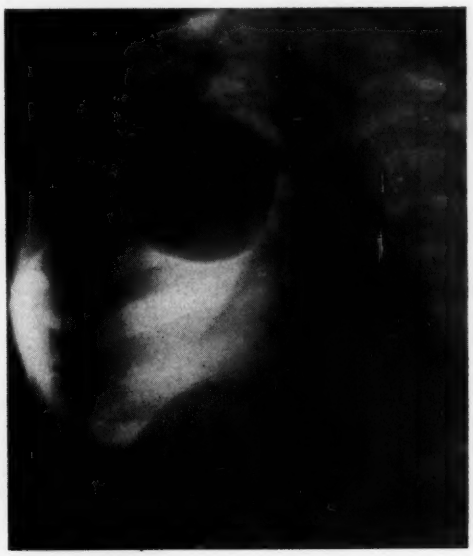

FIG. 405.—*Case* 1. Artificial pneumothorax has been induced. Note edge of collapsed lung internal to and away from tumour.

X-ray Examination,—This showed a large globular opacity, occupying the upper portion of the right chest, with well-defined edges (*Fig.* 404). Artificial pneumothorax was successfully performed with oxygen, and subsequent skiagrams were taken. These showed the tumour standing out well from the collapsed lung, and therefore extrapulmonary (*Fig.* 405).

Thoracoscopy (Dec. 12).—The tumour was seen from four different points of view, as shown in *Fig.* 406, its attachment being anterior.

Operation (Dec. 18).—Endotracheal anæsthesia (Dr. Magill). An incision was made below the right breast, which was turned forwards as a large flap, and the

Fig. 406.—*Case* 1. Thoracoscopic views of tumour. They show: the upper part of the tumour with apex of right pleural cavity above (upper view); the inner edge of the tumour lying upon normal lung (left view); the outer edge of the tumour with parietes in the distance (right view); and the lower border of the tumour with lung subjacent (lower view). Taken together they give the whole outline of the tumour from the postero-external aspect of the chest.

pectoralis major was split in the line of its fibres. The chest was entered in the 4th intercostal space through a 5-in. incision, which exposed the lower edge of the tumour. Towards the middle line the 4th costal cartilage was divided and the tumour more easily defined. It was found to be arising from the 2nd and 3rd ribs, which were incorporated with it on their deep surfaces. The deep incision was carried up through the 3rd and 2nd costal cartilages and interspaces, and the upper limit of the tumour was seen to extend up to the 1st rib. The nervous and vascular structures to the right upper limb were displaced upward by elevation of the arm and by suitable retractors, and the muscles of the first intercostal space were incised.

The outer boundary of the tumour was now defined and the intercostal muscles and ribs were divided, the latter after crushing with bone forceps, and the tumour, with portions of the 2nd, 3rd, and 4th ribs and intercostal spaces, was removed. The pleura was carefully dried, and the pectoralis major, which had been retracted during the operation, was sutured, the lung being inflated before tying the final suture. The breast, which had been displaced inwards, was now turned outwards to its normal position as an extra covering, and sutured.

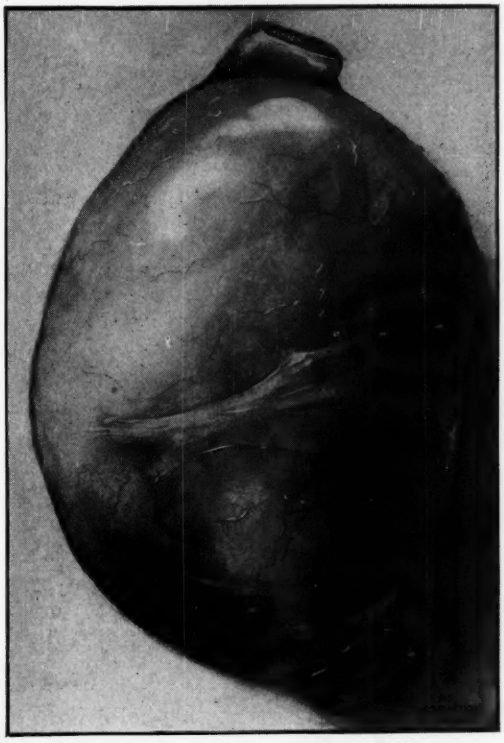

FIG. 407.—*Case* 1. Drawing of tumour immediately after removal. This is from the pulmonary aspect, and at the upper end can be seen the divided 4th rib. (× ¾.)

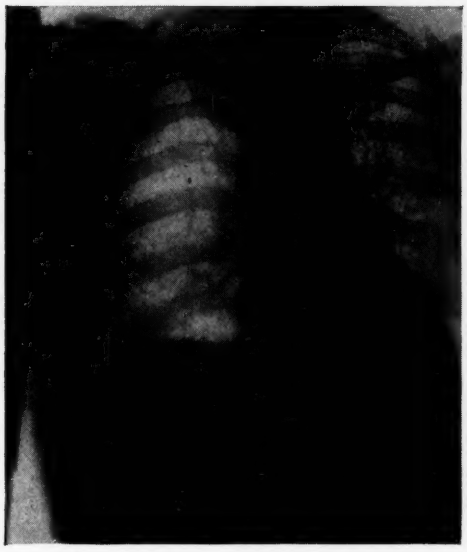

FIG. 408.—*Case* 1. Skiagram of chest, two months after operation. Close examination shows absence of the anterior ends of the 2nd, 3rd, and 4th ribs, and parts of their costal cartilages.

There was some degree of shock after the operation, but the pulse on the same evening was 108 and regular. On the fourth day 5 oz. of blood-stained effusion were removed from the chest. Following this, convalescence was uninterrupted.

PATHOLOGICAL REPORT.—(This is taken from the specimen in the R.C.S. Museum.) (*Fig.* 407.) Ovoidal chondrosarcoma measuring 4 by 2½ in., together with portions of 2nd, 3rd, and 4th ribs. It is smooth on the surface, surrounded by a fibrous capsule in which are numerous ramifying blood-vessels, and in section is seen to be devoid of lobulation and to consist of a tissue of obscurely fibrous appearance in which are scattered rounded and somewhat transparent areas, some of which have undergone softening. Numerous vessels of considerable size appear in the section. At the upper end of the specimen

is an outlying process of the growth which is apparently an infiltration of the rib or of the fatty tissue about an intercostal space.

Microscopical examination shows the growth to be a chondrosarcoma. It consists of spindle cells among which are several groups of large multinucleated cells. The tumour tissue also contains numerous small trabeculæ of imperfectly developed cartilage.

A skiagram taken three months later shows an apparently normal chest, but close examination shows absence of the anterior end of the 2nd, 3rd, and 4th ribs (*Fig.* 408).

In this case the interest lies in the fact that the whole of the growth arose from the deep surface of the rib or ribs and that there was no external evidence of tumour. The diagnosis as regards the exact position, the relationship between lung and tumour, and the appearance of the tumour was made before operation.

The author believes this to be the first case of intrathoracic tumour in this country in which artificial pneumothorax and thoracoscopy were used to aid diagnosis before operation, and in which therefore it was possible to plan the incision through superficial and deep parts of the thoracic wall so as to give best access for removal of the growth.

Case 2.—**Cyst in left lower pleural cavity. Removal: recovery.**
Miss S. G., age 30, nurse, a patient of Dr. G. Basil Price.

HISTORY.—The patient joined the Army in 1916 and served in Salonika for four months, being invalided home for dysentery and malaria in December, 1916. She was in England for four years, and then served in Germany until demobilization in 1922. In 1918 there was a sudden attack of influenza, sore throat, and pain in the left side. Fluid was stated to be present, but was not aspirated. She returned to duty in two months, but never felt well subsequently, having cough and pain in the left side at intervals. She has been in sana toria on and off for the last three years.

FIG. 409.—*Case* 2. Skiagram of large cyst in left pleural cavity. Note apex of tumour lies over cardiac area and not towards hilum of lung.

Fluid was aspirated in January and September, 1923, and in October, 1924—12 to 24 oz. each time. Straw-coloured fluid was withdrawn at first, but later it became brownish. There was no wasting, but considerable loss of strength and energy, and definite dyspnœa. Sputum had been examined on several occasions, but was always negative for tubercle bacilli.

ON EXAMINATION.—Diminished expansion of the left lower chest, with dullness and absence of breath-sounds up almost to the spine of the scapula. No tactile fremitus was elicited over the same area. The heart was not displaced. There was no evidence of disease of the right lung, and no adventitious sound in the left lung. Abdomen, no appreciable disease. Temperature, normal; sputum, nil. Fluid was aspirated from the left chest and found to consist of a serous fluid loaded with cholesterin crystals, which gave it a brown colour and shimmering appearance. No organisms were present.

X-ray Examination.—This shows a large pear-shaped shadow with the apex towards the middle of the heart shadow (*Fig.* 409).

Artificial pneumothorax was impossible owing to adhesions. A diagnosis of intrathoracic cyst was made.

Operation (May 8, 1925).—Intratracheal anæsthesia (Dr. Magill). A curved incision was made from the axilla downwards on the outer side of the left breast. The breast was turned forward and the 5th interspace opened up. Adhesions to the pleura were separated, and showed a large tumour present in the lower part of the left pleural cavity. It was adherent to the lung above and posteriorly, the diaphragm below, and the pericardium internally. The adhesions were separated at all points except the pericardial attachment, which was very dense over an area the size of a five-shilling piece. It was considered more advisable to leave this than remove the involved area of pericardium, and the cyst was then removed after incision.

Fig. 410.—*Case* 2. Skiagram after removal of cyst shows a certain persistence of the cavity from which the cyst was removed and formed by compressed pulmonary tissue. This was taken three weeks after operation.

The lining membrane of the portion left behind was then excised, leaving only a thin layer of the fibrous outer coat behind. No communication with the pericardium was present. The chest was swabbed dry, and the chest wall sutured by five pericostal sutures and the muscles in layers. Before tying the last suture the lung was distended by positive intratracheal pressure as far as possible. The condition of the patient was excellent on leaving the table. The cyst on removal held between 1½ and 2 pints of fluid.

Fig. 411.—*Case* 2. Large cyst removed from left chest. Opening at apex shows where a small portion has been left behind on the pericardium, the lining being removed, and where sections have been cut for microscopy. (× ⅜.)

Four days later 22 oz. of clear fluid were removed from the chest; on examination this proved sterile. Ten days later another 6 oz. were removed. Convalescence was steady and uninterrupted. A skiagram taken three weeks after operation showed a diminished cavity from which the cyst had been removed (*Fig.* 410). A skiagram taken after four months showed full expansion of the lung, with disappearance

of the old pleural thickening, and the physical signs were normal. (Unfortunately the skiagram was lost, and the patient being in a remote part of Ireland has prevented another being taken.) She is now quite fit and without symptoms.

PATHOLOGICAL REPORT.—(This description is from the specimen in the R.C.S. Museum.) (*Fig.* 411.) A large cyst removed by operation from within the chest. It measures nearly 5 in. in diameter, and is covered partly by pleura, partly by loose areolar tissue. Its wall is in part several millimetres in thickness, in parts as thin as tissue paper. It has a smooth lining and contained a brownish fluid with crystals of cholesterin.

Microscopic examination shows the cyst wall to be composed of dense hyaline fibrous tissue. No epithelial or endothelial lining can be detected.

The first interesting feature about this case is the diagnosis. For three years it had been taken to be an encysted collection of fluid, probably tuberculous in nature. The points against this diagnosis are the localized nature of the disease, the X-ray appearance, and the lack of generalized symptoms. Taking them seriatim, it is improbable that an encysted collection of tuberculous nature would be so long-standing as seven years without there being evidence of other changes in the lung itself. The X-ray appearance shows one feature which in the author's opinion militates against the diagnosis of an interlobar effusion—namely, that the apex of the pear-shaped shadow is directed to a point well below the position of the hilum of the lung, where one would expect it in an interlobar effusion. There would probably be more marked loss of weight, sweating, and other symptoms in tuberculous effusion in which the disease was active, and, lastly, one would expect the fluid withdrawn from the cyst to be thicker and more cellular in nature.

The other question of interest is the origin of the cyst. The absence of a true cellular lining makes exact diagnosis impossible. Is this a dermoid cyst arising in the anterior mediastinum and enlarging, which takes the line of least resistance into the pleural space, compressing the soft lung; or is it a primary diverticulum from the pericardium, the communication of which has become shut off as enlargement occurred? A definite answer is impossible, but its firm attachment to the pericardium is rather in favour of the latter. The loss of the lining membrane may have occurred owing to repeated hæmorrhages into the cyst, which also accounts for the excessive quantity of cholesterin present.

Case 3.—**Teratoma of right lung—rupture into lung. Removal in two stages: recovery.**

Miss D. P., age 20, admitted to the private ward at Brompton Hospital under Dr. G. E. Beaumont on Oct. 5, 1925.

HISTORY.—Pain in the right shoulder, with dullness of the right chest. Exploration with a needle gave a negative result; diagnosed as tuberculosis or growth. Shortly after she coughed up a 'lot of matter'.

In 1922 there were bulging of the right side in the neighbourhood of the nipple; cough, and offensive sputum; dullness still present. The sputum gave a ? + reaction for tubercle bacilli. The chest was explored three times, but no fluid was found.

In 1925 the patient was fairly well until the early months; she then had influenza (?); she was X-rayed, and fluid was reported in the chest, which was aspirated weekly (60 oz.). The fluid was originally cheesy and thick, but later more fluid and chocolate in colour.

ON ADMISSION.—The patient was gravely ill, with high temperature and pulse, and expectorating 25 oz. of foul-smelling sputum.

ON EXAMINATION.—There were signs of dullness over almost the whole of the

right chest, 32 oz. of 'anchovy fluid' were withdrawn, and 175 c.c. of air introduced. Microscopical examination of the fluid showed small masses of sebaceous material with two hairs. The sputum contained no tubercle bacilli, and there was no evidence of dermoid contents.

X-ray Examination. — Showed a cavity in the chest with fluid in the lower portion and a rounded tumour at the upper end (*Fig.* 412).

Thoracoscopy (Oct. 29).—This showed a large space with fluid below and masses of sebaceous material floating on the surface. Above, a tumour could be seen passing from the inner to the outer part of the apex of the cavity, the former attachment being broad and the latter narrow.

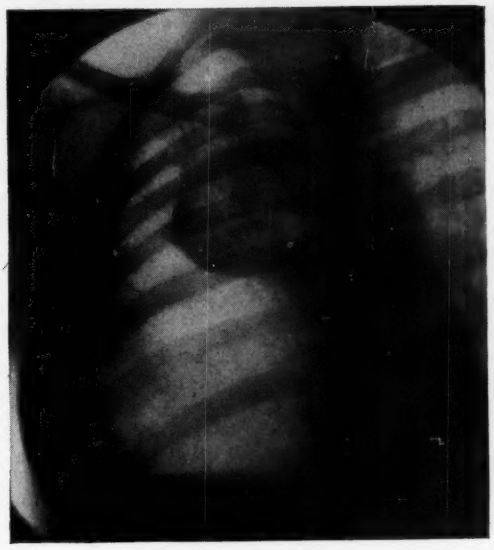

FIG. 412.—*Case* 3. Skiagram of right chest, showing large cavity in lung in which most of the fluid has been withdrawn and replaced by air. In upper portion is seen an irregular tumour.

FIRST OPERATION (Nov. 2).—Thoracotomy under intratracheal anæsthesia (Dr. Magill). Intercostal incision in the 5th interspace in the anterolateral part of the chest after turning up the right breast. The pleural cavity was opened, and one pint of fluid was found, of thick soup-like consistency and containing hairs and masses of material like yolk of egg. The cavity was swabbed dry and found to be completely surrounded by lung, the peripheral part being thin, solid, and airless. In the upper part of the cavity was a tumour the size of a tangerine orange attached to the upper lobe bronchus. This was removed as far as possible, without damage to the bronchus, and consisted of multiple cystic areas. The upper part of the pulmonary cavity was lined by what appeared to be normal skin, probably as a result of previous rupture of a cyst. This lining was removed intact. The main portion of the pulmonary cavity, which did not communicate with the bronchial system, had calcified plaques in the walls, large portions being removed at operation. At the end of the operation the chest wall was closed without drainage.

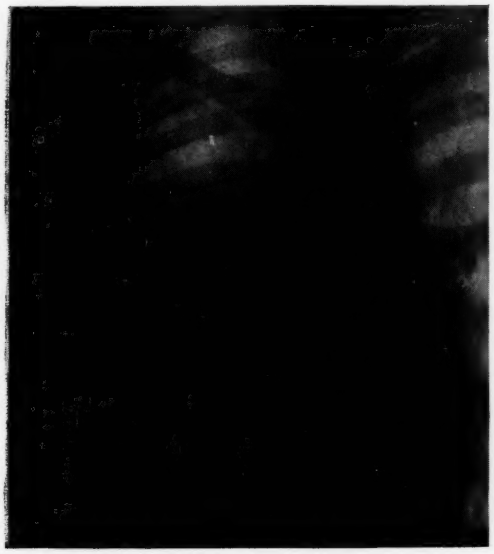

FIG. 413.—*Case* 3. Skiagram showing appearance of chest after removal of tumour.

After-treatment.—Fluid was removed at intervals of a few days on six occasions, starting with 2 pints and going down to 11 oz. No further fluid could be obtained, and the lung was expanding well—confirmed by radiography. The sputum immediately disappeared, and was obviously due to secondary dilatation of the lower bronchi by pressure. The wound remained healed for six weeks, and the patient was up and about when a small area broke down and was found to lead to a track in the lung. The patient was temporarily discharged with a tube *in situ*.

SECOND OPERATION.—Owing to inability to replace the tube, the patient was readmitted. The old thoracotomy wound was reopened, and the remainder of the tumour, which had become further extruded from the lung, was removed without very much difficulty. The chest was closed around the tube after removal of a few calcified plaques.

Convalescence was uninterrupted, and on Sept. 10, 1926, the patient was discharged with the wound soundly healed and full lung expansion. Her general health was excellent. (*Fig.* 413.)

PATHOLOGICAL REPORT.—Microscopic section shows large masses of sebaceous glands, with connective tissue interspersed, and covered at certain points by stratified squamous epithelium.

This patient shows the result that may be expected to occur when intrapulmonary teratomata are left alone, and affords a very good reason why removal should be attempted as soon as a diagnosis is made.

There is no doubt that one of the cavities of the multiloculated tumour burst into the lung, forming an extraneous cavity surrounded by lung tissue. The constant secretion from the wall of the cyst gradually increased the size of the pulmonary cavity until it held a large quantity of fluid and caused complete collapse of the surrounding lung. The pressure of the fluid gave rise to definite obstruction to the bronchi of the lower lobe, resulting in a condition of bronchiectasis, which increased until the sputum amounted to 25 oz. per diem. The relief of the pressure was shown by the almost immediate disappearance of sputum following operation.

The operative difficulties are increased also by the delay in adequate treatment, as the tumour loses its definite boundaries and the line of cleavage is not so clearly defined.

Case 4.—**Teratoma of lung, removed in three stages: recovery.**

J. G., age 27, male clerk, admitted to the Brompton Hospital under the care of Dr. Hope Gosse on Nov. 16, 1925.

HISTORY.—The patient had a fall in March, 1925, followed by pain in the right chest and back for one month. In June there was recrudescence of pain. In September cough came on gradually, later with expectoration, and three weeks before admission there was a definite attack of hæmoptysis.

ON EXAMINATION.—The physical signs consisted of absence of breath-sounds over an area of the front of the right chest from the upper border of the 2nd rib and costal cartilage to below the 6th rib. In this area there was complete absence of breath-sounds and vocal fremitus. The temperature was 98·8–99°, pulse 80–96. A needle was inserted into the dull area without result.

X-ray Examination.—A skiagram showed a large tumour present in the right lung (*Fig.* 414).

Artificial Pneumothorax.—This was induced with a view to clearing up the diagnosis, but was only partial in its result owing to adhesions.

Lipiodol Injection.—The skiagram following injection indicated that the bronchi were free and not dilated.

FIRST OPERATION (Jan. 6, 1926).—The chest was freely opened by an intercostal incision in the 5th space anterolaterally. Normal lung was visible above and the diaphragm below. The middle portion of the lung contained a large mass, about the size of a grape-fruit, firm in consistency, with very hard nodules over its surface, and covered by about half an inch of collapsed lung. It was first thought to be malignant. An exploring needle was introduced into the mass with negative result.

The overlying lung was incised and a further incision made into the tumour. A quantity of hair and sebaceous material was extruded. An attempt was then made to separate the outer wall of the tumour from the lung tissue. This was difficult owing to close adhesions, and a fair amount of oozing resulted. As a result of a fall

in blood-pressure the chest was closed after separating one half of the tumour from the lung, and the separated areas were kept apart by a piece of gauze, and a water-seal drain was inserted.

Following the operation a fair amount of blood-stained serum oozed into the dressings for several days, but, in spite of a certain degree of bronchitis, recovery resulted.

Second Operation (Feb. 3).—A further exploration was done through the original incision. The tumour was held by forceps aud freed completely except at its base, which extended into the mediastinum. The wound was treated in the same way as formerly. The further convalescence was interrupted by a lesser degree of bronchitis.

Third Operation (March 3).—Exploration was carried out through the previous incision, but extended upwards by division of the costal cartilages of the 5th, 4th, and 3rd ribs. The tumour now presented much more easily, and was removed without difficulty. A small bronchial fistula was present. Convalescence was much easier, and the wound and fistula healed within three weeks.

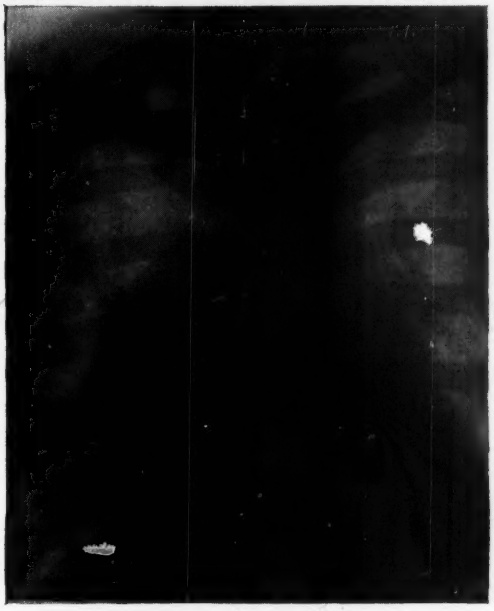

Fig. 414.—*Case* 4. Showing a large tumour in the lower right chest.

The patient, whose weight was 9 st. 10 lb. on admission (Nov. 16, 1925), weighed over 12 st. in September, 1926, and was very fit; there were no abnormal physical signs in the right chest (*Fig.* 415).

Fig. 415.—*Case* 4. Skiagram three weeks after removal of tumour.

This case illustrates well the necessity of proceeding in stages with the more difficult intrathoracic tumours. There is no question that the patient would have succumbed had the attempt been made to carry out the complete operation at one sitting. In addition to this, there can be no doubt that the decompressive effect of the first operation resulted in the tumour being gradually extruded, in a somewhat similar manner to the intraspinal tumours operated upon in two stages.

A point with regard to the anæsthesia can also be stated here—that when the lung is adherent there is no necessity to use any form of intratracheal anæsthesia, and that gas and oxygen given in the usual way is more satisfactory. The former was

used for the first and the latter for the two subsequent stages. Bronchitis was a more marked feature of the first post-operative period than the others.

Small and moderate-sized bronchial fistulæ heal over with lung tissue most readily if they are deeply situated and the surrounding walls of the track are not rigid.

The appearance of the first skiagram (*Fig.* 414) would almost suggest a malignant tumour invading lung tissue and arising in the hilar region, and only exploration proved its benign nature.

FIG. 416.—*Case* 4. Teratoma removed from right lung and mediastinum. (× ⅜.)

PATHOLOGICAL REPORT.—(Taken from the specimen in the R.C.S. Museum.) (*Fig.* 416.) One-half of a teratoma removed from the chest by operation. It is of rounded form, irregularly and coarsely lobulated on the surface, and measures 3 in. in diameter. The section shows it to be of complex structure, consisting partly of areas of fat, partly of indefinitely arranged tracts and areas of fibrous tissue with scattered cystic spaces, some of which contain coagulated mucus. There are also opaque white areas of cartilage, and in the upper half a slit-like space lined with skin; this cavity contained hairs. Near the left edge of the specimen are two areas containing bone.

Microscopical Examination of sections from seven different parts of the tumour shows the following tissue: True skin, with sebaceous glands (from the upper margin of the horizontal cleft); tubular spaces lined with columnar ciliated epithelium; indefinite masses of smooth muscle-fibres; lymph follicles and great numbers of mucous glands, many of them in the vicinity of the tubes lined with columnar epithelium, and in places definitely connected with them; masses of hyaline cartilage; numerous areas having the structure of neuroglia; and masses of fatty tissue. The cyst at the right edge of the specimen is lined with a non-ciliated

FIG. 417.—*Case* 4. One section from teratoma of lung and mediastinum, showing varied types of tissue. (× 90.)

columnar epithelium, several layers thick. In one of the sections is a narrow tract composed apparently of medullated nerve-fibres. There are no evidences of any malignant changes (*Fig.* 417).

Case 5.—**Endothelioma of right lower lobe. Lobectomy: death from reactionary hæmorrhage.**

H. F., male, age 60, admitted to Westminster Hospital under Sir James Purves-Stewart on Jan. 8, 1926.

HISTORY.—Three years ago the patient had severe hæmoptysis—3 pints (?). One year ago he became suddenly blind in the right eye. Five weeks ago there was incontinence of urine when he walked about. He complained of continual gripping pain in the right lower back of three days' duration—worse on walking. He has had some lumbago for eighteen years. In addition to the pain there was complaint of cough, loss of appetite and sleep, wasting, and sweating.

ON EXAMINATION.—Cardiovascular system: mitral systolic murmur at cardiac apex; blood-pressure $\frac{210}{120}$; some arteriosclerosis. Respiratory system: patch of

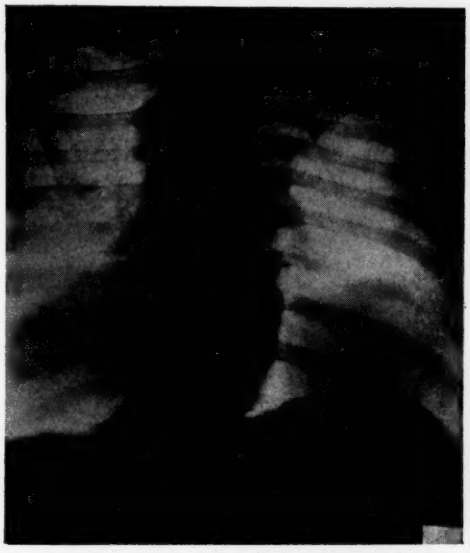

FIG. 418.—*Case* 5. Right chest from behind, showing tumour with definite outline and without evidence of pulmonary reaction around.

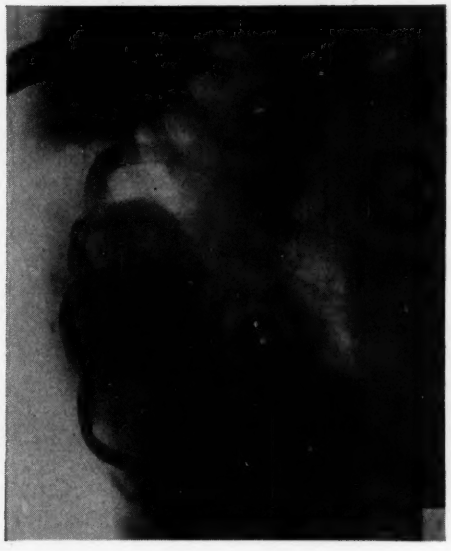

FIG. 419.—*Case* 5. Lateral view of chest.

bronchophony at right apex—front and back; dullness with diminished breath-sounds and vocal fremitus and resonance at the right base; in the right subclavicular region crepitations were present, accompanying bronchial breathing and associated with increased vocal resonance. There was considerable old dorsolumbar scoliosis, convex to the right. Urine examination: no tubercle bacilli found; albumin and casts present. Sputum examination (two occasions): tubercle bacilli not found; no fragments of growth detected.

X-ray Examination (*Figs.* 418 and 419).—The right diaphragm did not move well; there was evidence of fibrosis and excavation at the right apex; at the right base there was a large rounded shadow above the diaphragm—? cyst or new growth. It was regular and of moderate density, lying rather more posteriorly than anteriorly, without any evidence of reaction in the surrounding lung, and with an area of unaffected lung between the tumour and the hilum.

Artificial pneumothorax was attempted with a view to showing the relationship between the tumour and the lung, but proved impossible owing to adhesions between

the lung and the chest wall. Aspiration withdrew some blood and fibrin. The Wassermann reaction was negative, and the blood-count was comparatively normal. Ophthalmic examination disclosed loss of the upper half of the right visual field.

Exploratory thoracotomy was decided upon, with a provisional diagnosis of malignant disease.

Operation (March 4).—Under paravertebral anæsthesia with novocain 1 per cent, an oblique incision 7 in. long was made along the right 7th rib from the angle forwards; 6 in. of the rib were resected and the pleura was opened. There were fine adhesions between the lung and chest wall which were easily separated, and the condition shown in *Fig.* 420 was disclosed. The major portion of the lower right lobe was filled with a firm nodular growth. The lobe was easily separated from the

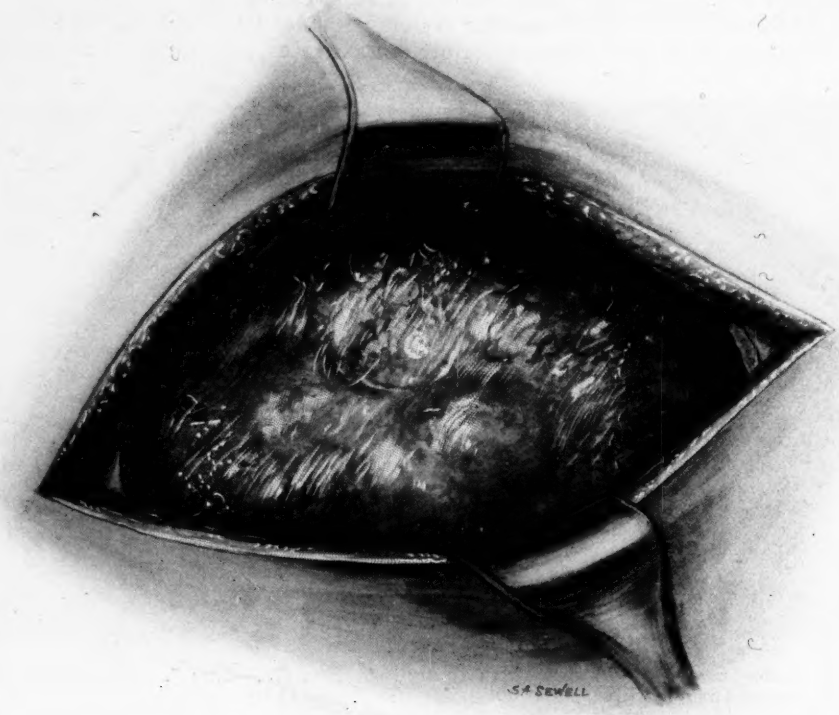

Fig. 420.—*Case* 5. Appearance on opening right pleural cavity after separation of fine pleural adhesions.

parietes and the mediastinum, but was firmly adherent to the diaphragm. The diaphragm was incised, and that portion 3 in. by 2 in. attached to the lower lobe was divided from the rest of the diaphragm. The deficiency was closed by suture. The lower pulmonary lobe, including the growth and the portion of attached diaphragm, was then partially withdrawn from the chest. The hilum was ligatured off by a series of ligatures and transfixing sutures after crushing the larger bronchi, and the mass removed. The chest wall was firmly sutured with an airtight tube *in situ*. This was clamped off and opened under fluid on the patient's return to bed,.

The general condition of the patient at the end of operation was excellent, the pulse being regular, strong, and 90 per minute in rate. Apart from the period when the diaphragm was incised, when gas and oxygen was used for about four minutes,

the whole operation was completed painlessly with the paravertebral anæsthesia. For the following nine hours the patient was very comfortable, but after this time the pulse commenced to fail. Preparations were made for blood transfusion, but, before this could be done, air-hunger set in, with loss of consciousness and Cheyne-Stokes respiration, and the patient died rapidly.

FIG. 421.—*Case* 5. View of lower lobe of right lung after removal. The cut bronchi can be clearly seen, and below the area of diaphragm attached to the tumour. No evidence of the growth can be seen from this aspect, showing that removal has been complete. (× ⅔.)

POST-MORTEM EXAMINATION.—The right pleural cavity contained 20 oz. of blood. The right lower pulmonary lobe had been removed. No secondary deposits were present in the mediastinum or visible elsewhere. The bleeding had apparently resulted from puncture of an intercostal vessel during suture of the chest wall. There were tuberculous excavations of the apex of the right lung.

PATHOLOGICAL REPORT.—(Taken from the specimen in the Royal College of Surgeons Museum.) (*Figs.* 421 and 422.)—One half of a plexiform sarcoma removed by operation from within the chest. The tumour is irregularly rounded in form, and is composed of an opaque white, somewhat granular-looking tissue, having a striated character in places. It is adherent below to a portion of the diaphragm, and in the rest of its extent is surrounded by adherent lung. The section shows the tumour to be coarsely lobulated, and the upper lobule has a somewhat slaty colour, suggesting that the lung tissue has been invaded by it; and the central part of the growth is softened and encloses a small area of lung tissue, which has apparently become included between two lobes of the tumour. At the external aspect of the specimen, where it is covered by adherent pleura, the growth has infiltrated the latter in the form of a flat rounded nodule showing marked vascularization at its periphery.

FIG. 422.—*Case* 5. Naked-eye section through lower lobe of right lung showing growth involving major portion of lobe. At the upper part can be seen an area of normal lung. (× ¾).

Microscopical Examination.—This shows the growth to be a plexiform sarcoma composed of broad, branching, solid columns of cells, many layers thick, and lying in a stroma of fibrous tissue. In many places the central part of the masses have undergone degeneration.

This case presents many interesting features: (1) The definite possibility of successful removal of a lobe of the lung containing growth, without serious shock, even in an old individual. (2) The fact that on occasions—rare, however, in the author's experience—growth may commence either in the lobe itself or in the periphery, and that it is possible in these cases to eradicate the disease completely in the early stages. (3) The value of local anæsthesia is well illustrated, as those parts of the operation on the chest wall and lung itself were absolutely painless, and only when there was interference with the diaphragm and its pleura was there any sensation.

In this case, in contrast to the others of this series, a portion of rib was removed for better exposure of the thoracic contents owing to the extreme rigidity of the chest wall in an aged individual, and especially in one the subject of advanced osteo-arthritis—the danger of damaging the intercostal vessels is self-evident. Another interesting point is the combination of a malignant growth and active tuberculosis, which has been previously described by many writers.

Lastly, although an airtight drainage tube was temporarily placed in the chest, no excessive bleeding occurred through this, showing either that it became blocked with clot or that it was obstructed by the expanding upper and middle lobes or by the rising diaphragm. In any case, it gave a feeling of false security as regards hæmorrhage, and hence delayed the use of such resuscitatory measures as blood transfusion until too late.

Case 6.—**Teratoma of right lung. Removal: recovery.**

Mrs. S., age 29, doctor's wife.

History.—Right basal pneumonia in November, 1920, followed by empyema which was operated upon on Dec. 6, 1920, one pint of pus being evacuated. This was performed at Portsmouth, and after a preliminary fall of temperature there was a rise again, accompanied by increase in the quantity of sputum. In February, 1921, aspiration was attempted without result. In April, 1924, the original wound was reopened and a small quantity of pus evacuated. The temperature generally became lower, but there was an evening rise. Pregnancy in 1922 terminated normally.

In the winter of 1924 there was a long spell of fever of three months' duration, followed by relief after the expectoration of over a pint of mucopurulent sputum within a week. Since March, 1925, there has been an evening pyrexia of 99° to 99·6°. Aspiration in March was negative. Several examinations of the sputum failed to show tubercle bacilli.

On Oct. 23, 1925, the case was referred to the author by Dr. R. A. Young as one of either interlobar empyema or pulmonary abscess. The X-ray showed a dark shadow in the right lung which was continuous with the mediastinal shadows. The central area was dark and surrounded by a lighter zone (*Figs.* 423 and 424. Lipiodol examination only showed very early bronchiectasis of the lower lobe.

Operation.—Thoracotomy was advised, and performed under intratracheal anæsthesia (Dr. Magill) on Nov. 1, 1925. A portion of the 6th rib was removed posteriorly and the pleura opened. Fine adhesions were easily freed, and the whole posterior part of the chest cavity and the interlobar fissures explored with negative result. The chest was then closed. An aspirating needle was inserted anteriorly, and a small quantity of (?) seropurulent fluid obtained. With the needle *in situ* a

portion of the third rib and costal cartilage was removed and the lung palpated. There was a firm thickened area in the hilum of the lung in close relation to the bronchi. Owing to the danger of opening main bronchi into the cavity, a firm pack was placed against the lung with a view to approximating the walls of what was considered to be an abscess of the hilar region.

Convalescence was uninterrupted, and the pack was removed on the fourteenth day. After healing, the sputum disappeared and the general health was very good. Subsequently, however, conditions returned to the *status quo*, and after further consultation another exploration was advised.

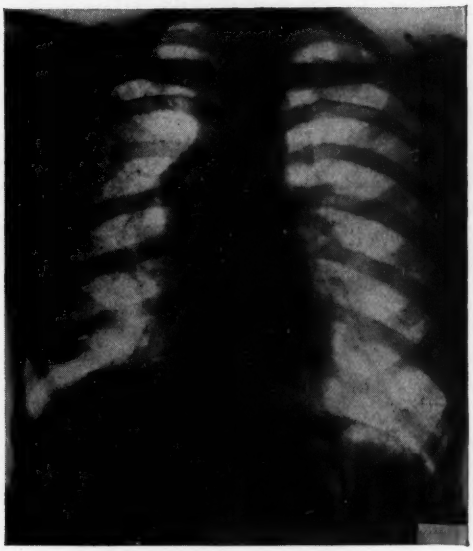

FIG. 423. — *Case* 6. Showing dark shadow extending outward from mediastinum into right lung. There is a small translucent area with a small dark mass in the centre. The sites of empyema drainage five years before, and of previous exploration, can be seen in the ribs.

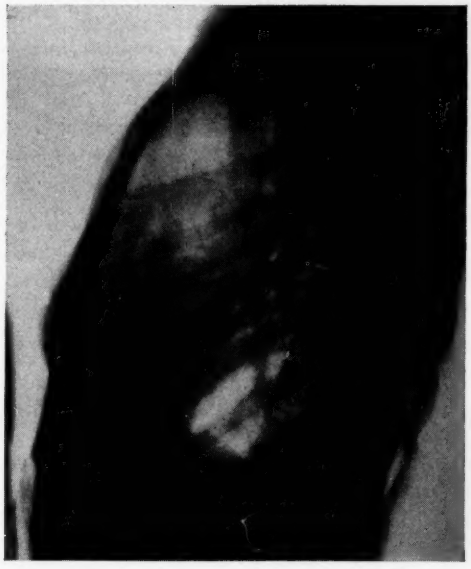

FIG. 424. — *Case* 6. Lateral view, showing tumour area lying about 1 in. below surface of anterior aspect of lung. The characters are the same as in *Fig.* 423.

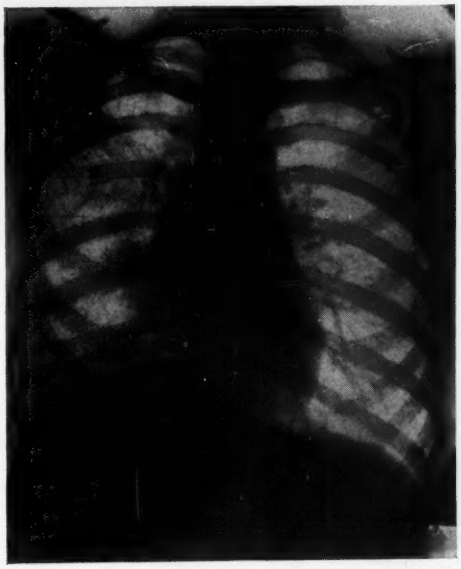

FIG. 425.—*Case* 6. Skiagram of chest about six weeks after operation.

SECOND OPERATION (May 20, 1926). —Intratracheal anæsthesia (Dr. Magill). Anterior exploration was carried out through the original anterior incision. The lung adherent to the chest wall was incised through ¾ in. of collapsed tissue and a firm-walled swelling exposed. Further exposure was obtained by division of the 3rd and 2nd costal cartilages. The swelling, after negative aspiration and packing off of surrounding area, was incised, resulting in the escape of some sebaceous material and several hairs. The tumour was then recognized as a teratoma or dermoid, and was gradually enucleated

from the surrounding lung. It was firmly adherent to the main bronchus of the lower lobe, and required careful separation. Extension occurred upwards towards the superior mediastinum, but the whole tumour was eventually delivered without any serious shock. The chest wall was completely sutured without drainage.

Reaction afterwards was comparatively slight, and the chest was aspirated of effused serum on two occasions. A slight leak of serum occurred through one of the stitch holes for a few days. The patient left the nursing home completely healed and convalescent one month from the day of operation (*Fig.* 425).

PATHOLOGICAL REPORT.—(Taken from the specimen in the R.C.S. Museum.) (*Fig.* 426.) The tumour is of flattened oval shape and measures 3 in. by 1½ in. The upper portion contains a cyst, from the wall of which several short hairs spring and which contained sebaceous matter. The cyst also contains a round firm body, which is attached by a long and narrow pedicle to its wall; this is of opaque white colour and is covered with corrugated skin. The lower part of the specimen is composed partly of solid tissue having the appearance of fibrous tissue, and of several cysts separated from one another by fibrous septa and mostly containing coagulated mucus.

FIG. 426.—*Case* 6. Appearance of cystic teratoma of lung removed from right lung and mediastinum. The upper part has been incised and shows parts of the contents. (× ⅔.)

Microscopical Examination.—This shows that the wall of the larger cyst is lined with squamous epithelium and contains sebaceous glands and hair follicles. The pedunculated body and its pedicle consist of dense fibrous tissue covered with stratified epithelium. The smaller cysts in the lower part contain coagulated mucus and are lined by a single layer of cubical cells, in close relation with which are groups of mucous glands and in one situation an elongated bar of hyaline cartilage. In other parts the specimen exhibits spaces lined with columnar epithelium passing into squamous epithelium; and, in connection with the former, numerous mucous glands, lymph follicles, and layers of smooth muscle. Other spaces are lined with ciliated, columnar epithelium, and their walls contain mucous glands, small nodules of cartilage, and bundles of smooth muscle.

The tumour also contained vesicular structures suggesting thyroid tissue; and in places groups of tubular glands, among which are numerous giant cells.

In this case it is significant that the symptoms are all dated from an attack of pneumonia followed by empyema. On account of this the history was misleading and gave rise to a false conclusion, although even without this it would have been almost impossible to have made a correct pre-operative diagnosis.

The value of lateral skiagrams is illustrated by *Fig.* 424, where the clear zone can be more definitely seen to be nearer the anterior chest wall than the

posterior, and by this means suggests the better angle of approach for operative removal.

One other point of interest in this case is that the patient's father had had two superficial dermoids removed some years before.

Case 7.—**Fibro-lipo-sarcoma of costovertebral angle. Removal: recovery.**

Mrs. L. D., age 47, referred to the author by Dr. G. Basil Price, was admitted to Westminster Hospital on April 16, 1926.

HISTORY.—There were no points of any significance in the past history except that the patient had had a cough following dry pleurisy four years previously. The present trouble commenced with pain in the right chest ten months before. It was becoming gradually worse and more continuous, though it was not enough to interfere with sleep. Examination gave evidence of a patch of dullness and diminished breath-sounds over the right chest posteriorly in the region of the spine of the scapula and below.

ON EXAMINATION.—*X-ray Examination* showed an oval shadow in the upper part of the right chest just external to the vertebral column and overlying the

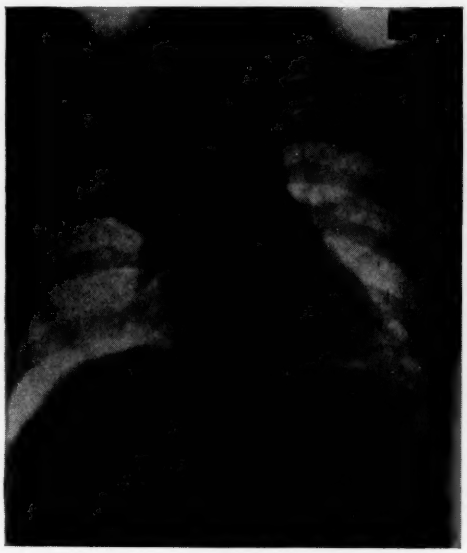

FIG. 427.—*Case* 7. Skiagram showing tumour in upper part of right chest.

FIG. 428.—*Case* 7. Lateral skiagram, showing tumour arising from region of costovertebral groove.

angles of the 5th, 6th, and 7th ribs at their posterior ends (*Fig.* 427). A lateral view shows the shadow to be within the chest cavity (*Fig.* 428).

Artificial Pneumothorax (April 22).—Artificial pneumothorax was performed and the lung partially collapsed. A skiagram showed the edge of the tumour beyond the lung edge above, thus proving it was extrapulmonary.

Thoracoscopy (April 26).—Thoracoscopy was performed and the instrument introduced below. The tumour could not be directly seen from this position, but a definite localized bulging of the lung was visible. The reason for this was disclosed at operation, where the lower part of the tumour was found covered by adherent lung.

OPERATION (April 29).—Intratracheal anæsthesia (Dr. Magill). The incision was made in the 7th intercostal space from the angles of the ribs forward to the axillary line. The pleura was opened, and the tumour seen lying in the costovertebral groove

(*Fig.* 429), as shown in the skiagrams. The 7th and 6th ribs were subperiosteally divided, but no portion of bone was removed. This gave considerable increase of

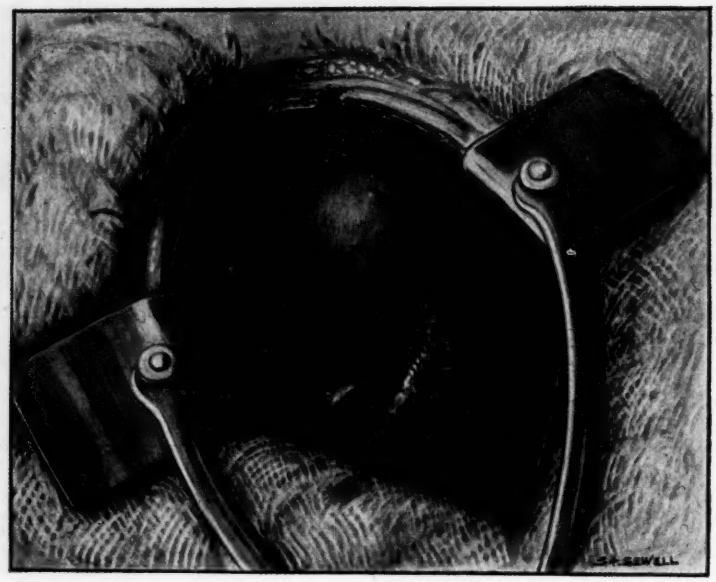

FIG. 429.—*Case* 7. Appearance of tumour and lung after exposure by intercostal incision and retraction of ribs. The lung has been slightly displaced downward and inward. The rib above has been divided in order to allow further retraction. ($\times \frac{3}{5}$.)

exposure without any division of the soft tissues. The adherent portion of the lung was separated from the remainder of the lobe and the raw area in the latter sutured. The pleura on the outer side of the tumour was incised, and the tumour removed from its attachment to the 5th rib together with the adjacent periosteum. The pleural cavity was mopped dry and the chest wall sutured in layers, the lung being inflated by positive endotracheal pressure before tying the last suture. No peri- or percostal suture was inserted, but the chest wall was firmly strapped over the dressings by overlapping strips in the manner adopted for fractured ribs.

FIG. 430.—*Case* 7. Skiagram of chest five weeks after removal of tumour.

Convalescence was rapid and uninterrupted except for the withdrawal of 5 oz. of blood-stained effusion on the fifth day. The patient was sitting up out of bed on the thirteenth day. A skiagram taken after operation is shown in *Fig.* 430.

PATHOLOGICAL REPORT.—(Taken from the specimen in the R.C.S Museum.) The tumour is nearly circular in outline, $2\frac{1}{2}$ in. in diameter, smooth on the surface, except for a portion of adherent lung, and surrounded by a delicate fibrous capsule (*Fig.* 431). In the section it is seen to consist of two types of tissue: a central dense mass having the appearance of hyaline fibrous tissue, and irregular, opaque, buff-coloured areas of softer consistence,

which are in places divided up by narrow hyaline tracts. The result of staining with Sudan III is shown in *Fig.* 432.

FIG. 431.—*Case* 7. Appearance of tumour after removal. Note portion of adherent lung removed with tumour.

FIG. 432.—*Case* 7. Appearance of tumour stained with Sudan III to show fat.

Microscopic Examination (*Fig.* 433).—This shows the growth to be a lipo-fibro-sarcoma. It consists partly of areas of closely-packed spindle cells, partly of areas of small polyhedral cells and extensive tracts of fat cells of an embryonic type, the

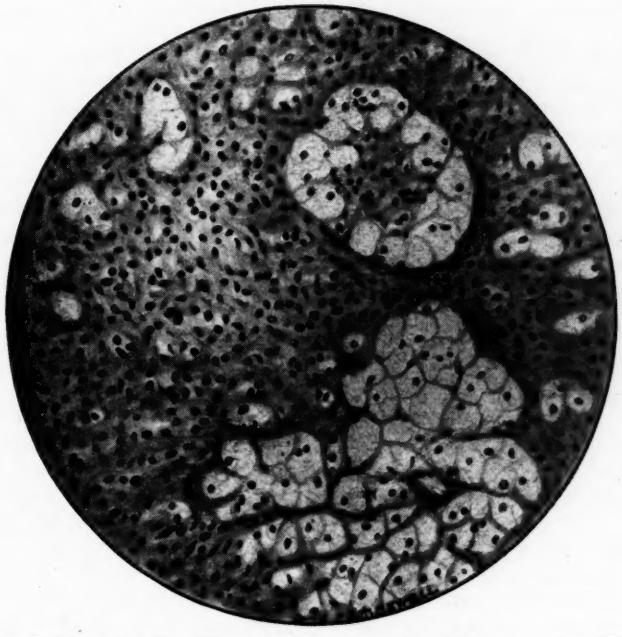

FIG. 433.—Case 7. Microscopic appearance of tumour. (× 275.)

fat being in the form of minute granules within the protoplasm. In the central parts of the tumour there is a large admixture of fibrous tissue.

In this case the diagnosis of the cause of pain and the situation of the tumour with its relationship to the lung was evidenced by skiagrams in different directions before and after artificial pneumothorax. Thoracoscopy was not so helpful, but would probably have been of more value if the site of introduction of the instrument had been higher. The appearance of the tumour at operation certainly suggested a benign growth, as it was only attached to a small portion of the rib of origin and came away comparatively easily. The microscopic appearances indicate a relatively small degree of malignancy, and therefore the prognosis would appear to be good. X-ray examination at the end of six months shows a normal chest.

SUMMARY.

1. A series of seven operable intrathoracic growths is recorded.

2. Of these, six have recovered and have apparently been cured.

3. One patient in whom death occurred illustrates the possibility of primary lobectomy in suitable cases. Also the risk of damaging the intercostal vessels is shown, especially when rib resection is used as a method of approach. Lastly, the case shows that intrapleural hæmorrhage may occur even in the presence of drainage without giving rise to any external evidence.

4. The value of operations in more than one stage is shown in two cases.

5. Endotracheal anæsthesia should be used where the pleura is free, but gas and oxygen by the ordinary method is better where adhesions are present.

6. The value of adequate X-ray examination is emphasized. Where possible, artificial pneumothorax should be done both as a diagnostic method and as a preliminary to operation, because the operative shock of opening the free pleura is reduced to a minimum in its presence.

7. Thoracoscopy, bronchoscopy, lipiodol injection, and bismuth-meal examination of the œsophagus may all prove valuable adjuncts to diagnosis and to subsequent treatment.

In conclusion, the author tenders his thanks to those physicians who have referred their cases to him, and for their kind help and advice in treatment. To Dr. Stanley Melville and to Dr. W. H. Coldwell is also due much gratitude for the excellent skiagrams and their reproduction, without which the results attained would not have been possible; and last, and by no means least, to Dr. I. W. Magill for his great skill and judgement in the administration of the anæsthetics in the whole series of cases.

SOLITARY CYSTS OF THE KIDNEY.

By ANDREW FULLERTON, C.B., C.M.G., Belfast.

Solitary cysts of the kidney are rare. Young,[1] of Baltimore, for example, in his *Practice of Urology*, says, "there has not been a case discovered among the 12,500 at the Brady Institute". Cases do, however, crop up from time to time, and in recent years several papers have appeared on this subject. Kretschmer,[2] Harpster[3], Swartz[4], and Smith[5] have each published cases and discussed the diagnosis and treatment in the light of modern methods. Harpster, in describing two cases, reviews the literature and brings the number of reported cases up to 95. He has, however, omitted Kretschmer's case, which, with those more recently reported by Swartz and Smith, and the one about to be described, makes a total of 99.

The following case was recently under my care :—

Mrs. S., age 45 years. Family history unimportant. The patient has always been healthy and has had three children, the last three months before being seen by me. About a month after the last child was born the patient felt giddy while out walking. About a fortnight later she complained of a choking feeling and became very collapsed. Her medical attendant, Dr. G. G. Lyttle, of Belfast, attributed her symptoms to heat exhaustion, but made a careful physical examination of the patient, when an unexpected swelling was discovered in the right lumbar region. I saw her on July 26, 1926, and found a large, smooth, reniform, elastic, movable swelling, about half the size of a melon, in the right lumbar region. The patient did not complain of pain on firm pressure over the tumour ; she was, in fact, unaware of its existence. The urine was examined and found to be free from abnormal constituents ; there was no frequency and no history of hæmaturia. Cystoscopy was carried out on July 29. The urine collected through the cystoscope was clear amber, acid, free from albumin and sugar, but showed on microscopical examination a few red blood-cells, probably due to the trauma of the instrument ; pus was absent ; the bladder and ureteral orifices were normal. Catheters were easily introduced into the ureters and passed without difficulty the normal length toward the kidneys. Specimens were obtained from both kidneys ; the flow on the right side was much freer than on the left—nearly twice as much in a given time. Even allowing for possible leakage by the side of the catheter, there appeared to be a decided diuresis on the affected side. Three samples were taken from each catheter, and the specific gravity estimated by glass beads. The first and second were similar, 1010 on the right side as against 1015 on the left ; the third sample showed a specific gravity of 1005 on the right as against 1015 on the left. The diagnosis of a renal tumour, probably a cyst, was made from the situation, consistence, and shape of the tumour, and the difference in the flow and specific gravity of the urine on the two sides.

Operation (Sept. 20).—The right kidney was explored through a lumbar incision, and, being found to contain a large cystic swelling and several small cysts, was removed. The kidney, on removal, showed the following : Occupying the upper pole was a large cyst, somewhat lobulated on its surface, but apparently single, with very thin, transparent walls, almost like tissue paper, over which coursed small, thin vessels (*Fig.* 434). It measured 3 in. × 2½ in. × 2½ in. The capsule was thickened, and closely adherent to the perirenal fat. At the adherent parts it was opaque and white. Scattered over the cortex were several very minute cysts,

varying in size from that of a hemp-seed to that of a small pea. The ureter and pelvis were normal in appearance, and there was no connection between the cyst and the calices or pelvis. As it was desired to preserve the specimen, the kidney was not damaged by dissection, but some of the fluid was withdrawn by a syringe, the needle of which was passed through the substance of the kidney into the cavity of the sac. The fluid was straw-coloured, with a slight haze, had a specific gravity of 1015, became almost solid on boiling, and contained 0·5 per cent of urea. On microscopical examination a few red blood-cells were found, but no other cellular deposit. The fluid was sterile on direct examination and on culture. The blood-cells probably came from the kidney through which the needle had been passed to obtain the fluid.

A microscopical examination was made of one of the small cysts—the main cyst, being destined for museum purposes, was not interfered with. The parenchyma of the kidney in the neighbourhood of the small cyst was somewhat compressed and showed slight chronic inflammatory changes in the form of small round-celled infiltration. The wall of the cyst was formed by connective tissue without any demonstrable epithelial lining.

FIG. 434.—Solitary cyst of the kidney. Condition seen on removal of the organ.

Solitary serous cysts and solitary hæmorrhagic cysts appear to belong to a different category. Begg,[6] in reporting a case of the latter, holds that this condition is totally different from the solitary serous cyst. He says, "Large, solitary, hæmorrhagic cysts are excessively rare. They have few characteristics in common with solitary simple cysts, and should be placed in a different category". He suggests that solitary hæmorrhagic cysts "are of the nature of partial hæmatonephroses, where the source of the bleeding remains active over a long time. This source may be in the papillæ of the involved portion of the pelvis, and in the case reported an angioma was demonstrated". According to this view hæmorrhage into a solitary serous cyst does not constitute it a true hæmorrhagic cyst. The present article will deal only with solitary serous cysts.

Etiology.—Three views are held: (1) That they are due to embryonal rests; (2) That they are due to failure of union between the glomeruli and the collecting tubes; and (3) That they are retention cysts, due to constriction of the tubules by fibrous tissue or blocking of the glomeruli or tubules by desquamated and degenerated cells, favoured perhaps by small hæmorrhages. The view that finds most acceptance is that they are retention cysts, due to constriction of the tubules by sclerosis following chronic inflammatory changes. The fact that small cysts, indistinguishable from those seen in chronic interstitial nephritis, are sometimes found in the affection under discussion lends support to this view.

Pathology.—The cyst arises from the cortical portion of the kidney. It approaches the surface of the organ and thins out the cortex, which, with the capsule, forms the cyst wall. The latter may be lined on its inner surface by a delicate layer of cubical or flat epithelium, but this lining is absent in many cases. The contents of the cyst consist of a clear serous fluid in which small quantities of urea, and occasionally blood, may be found. The cyst very rarely communicates with the calices or pelvis of the kidney, though, when large, it may encroach upon these cavities, from which it is separated by a thin membrane.

Situation and Size.—

Situation.—The cyst is usually found on one side of the body only, and is situated, as a rule, at one of the poles of the kidney. In Harpster's series of 95 reported cases, 39 were in the upper pole, 20 in the lower pole, 6 on the convex border, 2 were in horseshoe kidneys, and in 28 the site was not stated. In Kretschmer's case the cyst was in the lower pole, in Swartz's in the lower pole, and in the present case in the upper pole.

Size.—These cysts vary in size from that of a hazel-nut to that of a man's head, or even larger.

Age and Sex Incidence.—

Age.—Most of the reported cases were in patients between the ages of 30 and 60 years. Four cases in Harpster's list were in children, two were 1 year old, one was 4, and one 8 years. The oldest patient was a male, age 89 years, under the care of Bockenheimer, who successfully resected a cyst from a horseshoe kidney.

Sex.—The condition is more frequent in females. Of the 99 recorded cases 28 were in males, 58 in females, and in 13 the sex was not stated.

Associated Abnormal Conditions.—Complicating these cysts the following have been found : hypernephroma, carcinoma of the kidney, malignant papilloma of the renal pelvis, horseshoe kidney, abnormalities of the renal blood-vessels, bifid pelvis, hydronephrosis and renal calculus, and tuberculosis of the kidney.

Side Affected.—In the 99 cases the right side was affected in 44 and the left in 38. In 17 the side was not stated.

Symptoms.—Symptoms may be entirely absent, as in the present case. A tumour in the abdomen may be accidentally discovered by the patient or his medical attendant. If the swelling is large it may exert pressure on the diaphragm or abdominal contents, giving rise to dyspnœa or gastro-intestinal symptoms. Pain, when present, may be constant or intermittent, and may be confined to the kidney region or radiate to the groin, testicle, or thigh. Typical renal colic, with vomiting, may be complained of. The urine may be perfectly normal, as in the case under review. Rarely, blood, and, still more rarely, pus, may be found in it.

Diagnosis.—An abdominal tumour, suspected as being of renal origin, is capable of being thoroughly investigated by the newer methods of diagnosis. A skiagram may be negative or may show an outline of the affected kidney. Pyelography will differentiate between hydronephrosis and cysts. In the former the enlarged pelvis and calices are easily recognized after the injection of an opaque solution such as iodide of sodium. Solitary cysts, according to

Braasch and Carman,[7] may give rise to the following changes: (1) Shortening of the adjacent calices; (2) Flattening of the nearest portion of the true pelvis; and (3) Changes in the axis of the kidney caused by the weight of a cyst seated at either pole. A normal pyelogram will not wholly exclude the presence of a cyst, which may be so situated as not to deform the pelvis. As a rule it is possible to distinguish solitary cysts from neoplasms of the kidney and polycystic kidney by the type of distortion of the pelvis and calices. In the present case the diagnosis of a localized cystic swelling of the kidney seemed so obvious by other methods of examination that pyelography was not resorted to. Alterations in the function of the affected kidney, when compared with its fellow of the opposite side, may give valuable information. In the present case an abundant flow of urine, with a specific gravity of 1010, dropping later to 1005, on the affected side, as compared with a more scanty flow of urine with a specific gravity of 1015 on the sound side, was considered sufficient to settle the diagnosis of an affection of the kidney as opposed to a tumour of another organ or one outside the kidney. This 'unilateral diuresis' has been found in tubercle of the kidney, renal calculus, pyelitis, tumours of the kidney, hydatid cysts of the kidney, and injuries to the kidney.[8,9] A specific gravity of 1010 was, moreover, considered too high to be that of the urine of a hydronephrotic kidney of sufficient size to produce the tumour found on physical examination. A large hydronephrosis is likely to be attended with urine of a much lower specific gravity than 1010. The usual specific gravity of the urine of a hydronephrotic kidney of the size of the organ here described would be 1005 or lower. The fact also that the specific gravity of the urine for the affected kidney varied from 1010 to 1005 during the examination showed, I think, that there was good functioning capacity on that side, as my experience goes to show that a badly damaged kidney has little or no range of concentration or dilution, but secretes fluid of almost uniform concentration throughout the examination. This examination further excluded such affections as distended gall-bladder, cyst of the liver, ovarian cyst, and other tumours not connected with the kidney. The elasticity of the swelling, as felt on abdominal examination, was strongly suggestive of fluid imprisoned in the kidney. The absence of the lobulation so characteristic of polycystic kidney was sufficient to exclude that condition. Hydatid cyst was negatived on account of its extreme rarity in people who have lived all their life in Ireland. Chromocystoscopy is another method of diagnosis that has been used, and would prove useful in deciding on the kidney as the seat of the affection, should any difference on the two sides be apparent.

Treatment.—Various methods of treatment have been employed, including puncture, incision and drainage, enucleation of the cyst, cuneiform resection, and nephrectomy. Puncture and incision have been abandoned. Enucleation is liable to leave uneven surfaces difficult to approximate with any prospect of satisfactory union and rapid healing. Cuneiform resection is the method of choice in a suitable case. A wedge-shaped piece of the kidney, including the cyst, is removed, and the cut surfaces are brought together with strong catgut. This operation was first carried out by Tuffier, and has been performed by Moynihan, Mazzoni, Semb, and others. Nephrectomy

will be required when the cyst is large and involves a large area of the kidney or when other cysts are present. In the case now recorded it was considered wise to remove the kidney on account of the presence of other cysts, possible immature forms capable of growing to a large size.

I am indebted to Miss Rea, of the Anatomical Department of Queen's University, Belfast, for the accompanying drawing.

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SOME OBSERVATIONS ON THE BONE CHANGES IN RENAL RICKETS.*

By E. P. BROCKMAN, London.

The presence in children of chronic interstitial nephritis associated with bone changes somewhat resembling those seen in rickets has, of recent years, been described by a number of observers under the name of 'renal rickets'. Recently Dr. Hugh Barber[1] has written an account of the clinical features of this condition, which he based upon his personal observations of seventeen patients. The observations put forward in this paper are concerned, not with the clinical features of the condition, which in my patients were similar to those which other writers have recorded, but rather with the X-ray appearances and histological changes that are seen in the bone, at the same time comparing these latter with the histological picture of normal bone and rickets.

CASE REPORTS.

Case 1.—A boy, age 14. When 2½ years old he suffered from an attack of acute nephritis. Up to the age of 7 he had repeated vomiting, for which his mother could furnish no cause. When he was 13 he began to complain of pains in his knees and to develop the deformity of genu valgum. This gradually increased until the time he came under observation, when there were eight inches of separation between the internal malleoli. At this time he was passing 50 to 60 oz. of pale urine daily, and his blood-urea was 102 mgrm. per 100 c.c. of blood. His muscle power was good, and there was no other bony deformity. The skiagrams of his bones (*Fig.* 435) illustrate, I believe, the typical condition as seen in renal rickets: (1) The changes affect principally the bone in the region of the growth disc. (2) The epiphysis itself is not markedly changed from the normal. (3) The diaphysis is slightly widened, but not to the extent seen in rickets. (4) The diaphysis in connection with the growth disc is not cupped in the same way as in rickets, but there is an irregular area of bone formation. (5) There is a marked increase in the depth of the non-ossified area between the epiphysis and diaphysis. (6) There is no obvious osteoporosis. (7) The shafts of the long bones are not affected in the way observed in rickets, there being no increase of the normal curves with supporting struts of periosteal bone.

Fig. 435.—*Case* 1. Skiagram of wrist showing typical changes in early renal rickets.

* From the Orthopædic Department, St. Thomas's Hospital. Read before the British Orthopædic Association, October, 1926.

FIG. 436.—*Case* 2, 1925. Skiagram of wrist showing advanced changes, the epiphyses being displaced from the shafts of the bones.

Case 2.—A girl, age 11, who, when 3 years of age, had an attack of acute nephritis which failed to clear up, and subsequently developed into a chronic condition. She was under treatment from 1918 to 1925, when she died of uræmia. Early in 1923—five years after she first had nephritis—she began to develop knock-knees, this gradually increasing in extent. Between July, 1920, and March, 1922, her blood-urea rose from 35 mgrm. to 162 mgrm. per 100 c.c. The skiagrams taken in 1925 show similar changes to those in *Case* 1, with the addition that in the wrist there is a displacement of the epiphyses of the radius and ulna (*Fig.* 436). At the lower end of the femur the epiphysis is also displaced backwards (*Fig.* 437). The only skiagram I possess taken at an earlier date is one of the knee-joint in 1924 (*Fig.* 438). In this it will be observed that the epiphysis of the femur is already displaced backwards, and that the line of ossification of the upper end of the tibia and fibula is apparently normal. Comparing this skiagram with the one taken twelve months later, it will be noticed that: (1) The non-ossified area between the epiphysis of the femur and the irregular bone formation has increased very markedly in width. (2) The irregular bone has increased in extent. (3) There has been some absorption of the bone at the lower end of the shaft. (4) The line of ossification at the upper end of the tibia and fibula is now involved. (5) There is a marked osteoporosis.

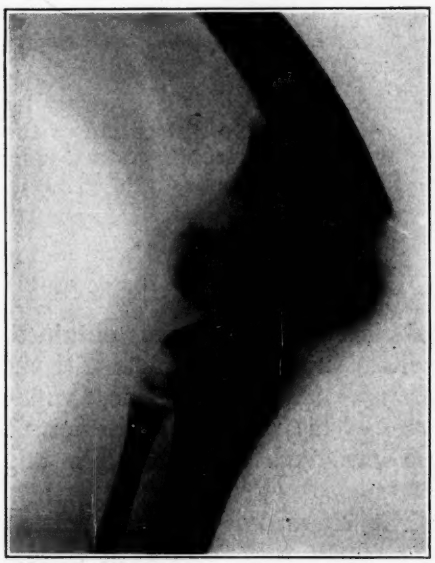

FIG. 437.—*Case* 2, 1925. Skiagram of knee (lateral view). Note displacement of epiphysis of femur and irregular bone formation.

FIG. 438.—*Case* 2, 1924. Earlier skiagram. Epiphysis already displaced but changes not advanced. Compare with *Fig.* 437.

Case 3.—A boy, age 13 months, who was admitted for the treatment of rickets. He had been fed upon a variety of artificial foods, all of which he vomited. His

growth had been normal until the age of 6 months, when his mother said he seemed to stop growing and she noticed that his right foot was turning inwards. He was a small child for his age, was very wasted, and had marked deformities of both upper and lower limbs, the hands being radially adducted (*Figs.* 439, 440) and the feet twisted inwards. The tibiæ showed no increase of their normalcurve. He had well-marked beading of the ribs, and swellings rather similar to those of rickets at the wrists and ankles. The skiagrams demonstrate very well that these deformities

FIGS. 439, 440.—*Case* 3. Skiagrams of wrist showing advance changes in an infant the subject of renal rickets.

are not due to any alteration in the shafts of the bones, but to dislocation of the epiphyses. At the lower ends of the radius and ulna the most recently formed bone is splayed out. The lower end of the tibia shows a similar condition (*Fig.* 441). There is a marked osteoporosis of all the bones.

EXAMINATION OF SPECIMENS.

It was from *Case* 3 that my pathological material was obtained. The body was very wasted and there was little subcutaneous fat. All the organs except the kidneys appeared normal. The suprarenals, which Ashcroft states had undergone changes in one of his patients, were normal both macroscopically and histologically. I removed the left tibia and fibula.

The Kidneys.—These were both excellent examples of the condition known as congenital cystic disease. Their surfaces were composed almost entirely of fairly large opalescent-coloured cysts (*Fig.* 442). The walls of the ureters were not thickened, and a fine probe could be easily passed along them. Divided in half, one of them showed, in addition to the cysts which were present throughout its substance, a thin cortex and atrophied medulla.

Histological examination demonstrated the changes of chronic interstitial nephritis (*Fig.* 443): (1) The glomeruli are fibrosed and the capsule is surrounded by fibrous tissue. (2) The tubules are dilated and cystic. (3) There is a large quantity of fibrous tissue throughout the substance of the kidney. (4) The small arteries show an advanced degree of endarteritis. (5) There is evidence of active inflammation in the presence of areas of mononuclear cells.

FIG. 441.—*Case* 3. Showing similar changes in the lower limbs.

The walls of the cysts on the surface are quite different in their structure from those formed by dilatation of the tubules, being composed of plain muscle-fibres (*Fig.* 444). This particular section was taken from an isolated cyst on the surface of the kidney which can hardly have had any connection with the pelvis, the only part of the kidney which normally has plain muscle-fibres in it. It is rather difficult to account for the presence of this muscle tissue; but one possible suggestion is that the cyst originated from a lymphatic space which has become occluded by the fibrous changes taking place in the substance of the kidney.

The Tibia and Fibula.—The shaft of the tibia (*Fig.* 442) was quite straight. The lower epiphysis was loosened and displaced inwards. The bone was very soft, being easily split with a scalpel. The periosteum was

not thickened. The bone exhibits a very thin cortex, with the lower epiphysis displaced inwards and an area of hæmorrhage between it and the diaphysis. The inner part of the end of the shaft has been absorbed, and the outer part is not connected by bone to the epiphysis, but by fibrous tissue and the periosteum. The upper epiphyseal line, though quite unlike that of rickets, is not as sharp as the normal. The medulla shows a large increase in its fat content.

In order to obtain for comparison evidence as to the differences from the normal and from rickets that are present in this specimen, examples were taken

FIG. 442.—Tibia split longitudinally: shows the displaced lower epiphysis, area of hæmorrhage in relation to it, and fatty marrow. Kidney with multiple cysts on its surface.

from children of approximately the same age. The normal tibia from a child 14 months old was much harder and had to be divided with a saw. It exhibited a good thick cortex, regular epiphyseal lines, and a good red marrow. The tibia from the patient with rickets split fairly easily with a scalpel. It had an increase of the normal tibial curve, a thickened periosteum, irregular epiphyseal line, and a more vascular marrow, which also had an increase over the normal in its fat content.

Histological sections demonstrating the normal bone, rickets, and renal rickets were prepared.

FIG. 443.
Section of kidney, showing the marked degree of endarteritis of the vessels and the severity of the chronic nephritis.

FIG. 444.
Section of cyst wall on surface of kidney. Note the plain muscle fibres composing it.

Normal Bone.—A section taken through the upper growth disc of the tibia (*Fig.* 445) shows the normal process of ossification taking place. The line of ossification is a regular one. The cartilage cells are arranged in columns. There are regular trabeculæ of ossifying bone with the osteoblasts arranged in order, and a normal red marrow.

Rickets.—A section taken through the upper growth disc of the tibia (*Fig.* 446) shows a very irregular line of ossification. Some of the cartilage cells, although arranged fairly regularly in columns, have failed to undergo

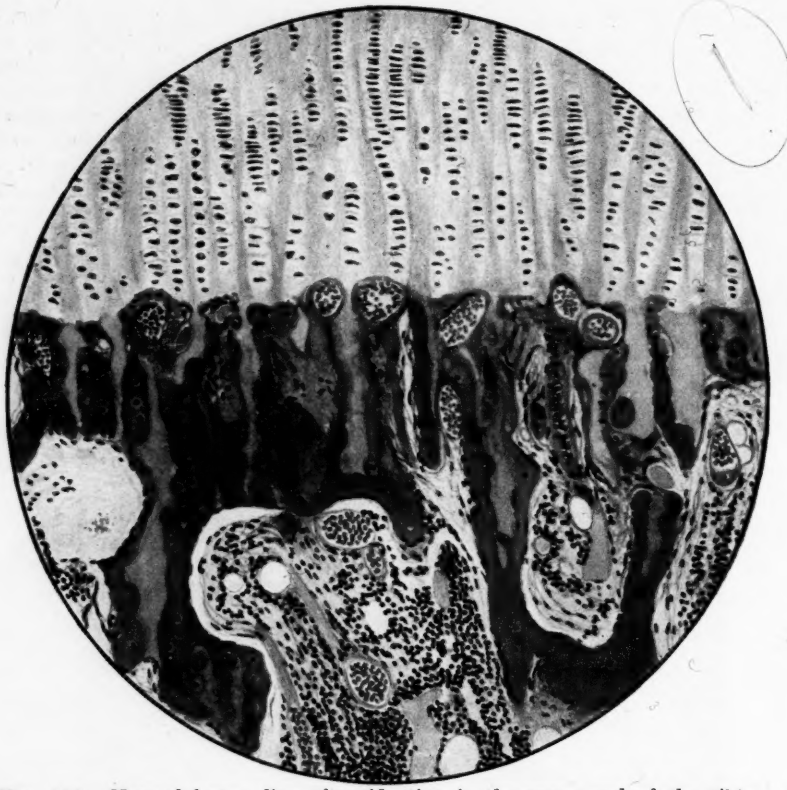

FIG. 445.—Normal bone: line of ossification in the upper end of the tibia.

calcification and ossification. There is an increased number of blood capillaries which are extending into the cartilage. The trabeculæ of bone are very irregular in comparison with the normal. The red marrow in relation to these bony trabeculæ has been replaced by a very cellular fibrous tissue.

Renal Rickets.—A section taken through the growth disc at the upper end of the tibia (*Fig.* 447) demonstrates very striking changes: (1) The red marrow is replaced entirely by fat. (2) There is an almost entire destruction of the regular columns of cartilage cells. (3) Active absorption of bone already formed by osteoclasts. (4) Little formation of new bone. (5) The whole area which normally should be occupied by columns of cartilage cells and bony trabeculæ is filled up with fibrous tissue. (6) There is an increase from the normal in the number of blood capillaries in this area.

FIG. 446.
Rickets: line of ossification in the upper end of the tibia. Note its irregularity.

FIG. 447.
Renal rickets: line of ossification in the upper end of the tibia. Note the replacement of red marrow with fat, destruction of the cartilage cells, masses of fibrous tissue, and the large number of blood capillaries.

Fig. 448 is a portion of the previous section under a higher power; it shows an area of calcifying cartilage surrounded by a cellular fibrous tissue, a few cartilage cells, and an increased number of capillaries.

Fig. 449 is a transverse section through the fibula; it demonstrates a similar condition. The red marrow is very largely replaced by fat. There is in the bone canals a similar condition, and the formation of fibrous tissue replacing the bone which has been absorbed. The small arteries of the medulla show thickening of their walls. *Fig.* 450 shows one of these vessels under a

FIG. 448.—Renal rickets: portion of previous section under a higher magnification.

high power. The muscular coat is markedly thickened, and there is a degeneration of the endothelial cells lining it, which are large and highly vacuolated.

Fig. 451 is a section taken through the tissue in contact with the lower tibial epiphysis; it shows an entire absence of bone and a large organizing clot containing a quantity of old blood pigment.

Longitudinal sections through the shaft of the tibia demonstrate the presence of large numbers of well-formed osteoclasts lying beneath the periosteum, between it and the bone, which are actively absorbing bone.

Comparing the changes that we find in renal rickets with rickets and the normal bone, we observe :—

1. The shafts of the bones in renal rickets are straight, and the deformities

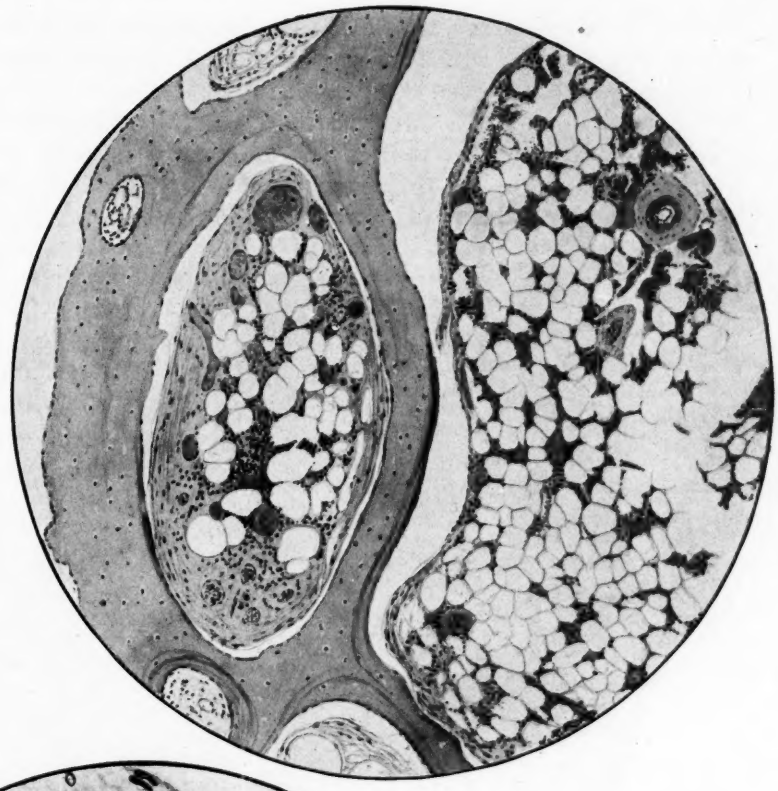

FIG. 449.
Renal rickets: transverse section through the fibula. Note the partial replacement of red marrow with fat, and the thickening of the vessel wall.

FIG. 450.
Renal rickets: vessel in medullary cavity of fibula under higher magnification. Note the thickening of the muscular coat, and degeneration of the endothelial cells.

when they develop are not, as in rickets, due to an increase of the normal curve, but are the result of separation and displacement of the epiphyses. This displacement is seen most markedly at the lower ends of the femur, tibia, radius, and ulna. The direction in which the epiphyses are displaced is, I think, governed by the pull of the muscles in relation to them.

It is not desirable to correct the deformities by osteotomy, primarily because of the danger of uræmia following the anæsthetic, and also the

FIG. 451.—Renal rickets: section of old hæmorrhage in relation to the lower epiphysis of the tibia.

deformity tends to recur. The deforming process—actual solution of continuity in the neighbourhood of the growth disc—is progressive, and the deformity has been known to recur after correction.

2. The red marrow is replaced by a fat marrow, more advanced in some bones than in others.

3. There is very little bone formation.

4. There is active bone absorption by osteoclasts both in the neighbourhood of the growth disc and also of the shaft of the bone beneath the periosteum.

5. Replacement of the absorbed bone by fibrous tissue. In rickets there is a quantity of fibrous tissue laid down among the trabeculæ of bone which have been formed, but in renal rickets it is very much increased in extent.

6. Thickening of the walls of the arteries in the medulla, with degeneration of the endothelial cells lining them.

7. An increase in the number of capillaries in the region of the growth disc as compared both with the normal and with rickets.

It appears that chronic interstitial nephritis has always been in existence in these patients for a long time before they develop any deformities and the changes become manifest in the skiagrams; also that these changes are progressive and appear in some bones before others. The lower ends of the long bones apparently are involved before other situations. It is reasonable, therefore, to suppose that they are in some way dependent upon the failure of the kidneys to carry out their function.

The severity of the nephritis as shown by the section of the kidney is very obvious, and there appears to be very little normal gland left to carry out its functions. I would suggest as a hypothesis that this failure on the part of the kidney allows a toxic condition to arise which influences adversely the delicate cells in the region of the growth disc and also the cells of the red marrow; and also that in the former their place is taken by fibrous tissue for the most part, and in the latter by the deposition of fat. In the section of the tibia the red marrow is almost entirely so replaced, but in the fibula this has not advanced to such a degree, showing that the condition is a slowly progressive one.

There is no evidence that the nephritis in these children is due to an ascending infection of the ureters, nor that it is related to nutritional changes, though the latter is a possible hypothesis. Another possible suggestion is that, whatever the factor which produces the chronic nephritis may be, it also subsequently causes the bone changes to take place.

I desire to express my thanks to Professor L. S. Dudgeon and Dr. A. L. Urquhart for their assistance and advice in the preparation of this paper.

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A CASE OF B. WELCHII CHOLECYSTITIS.

By E. PEARCE GOULD and L. E. H. WHITBY, London.

The patient, a married woman, age 43, with two children, was admitted to the Middlesex Hospital on November 7, 1926. She gave a vague history of slight indigestion for the past few months. Two days before admission she was seized with sudden severe pain in the right upper abdomen. On the day before admission she vomited twice.

On Examination.—The patient's temperature when first seen was 99°, pulse 100, and her respirations were 28. She appeared to be in considerable pain, chiefly in the right upper quadrant of the abdomen, but also extending down to the right iliac fossa. There was no rigidity of the abdominal muscles, and the respiratory movement of the abdominal wall was free and equal on the two sides, but a deep inspiration produced exacerbation of the pain beneath the right ribs. Deep palpation in this area elicited tenderness beneath the right costal margin, with reflex local contraction of the abdominal muscles. Nothing abnormal was detected on pelvic examination. There was no jaundice, and the urine was free from abnormal constituents. During the succeeding twenty-four hours the pulse-rate rose to 108, and the temperature to 101·2°. A diagnosis of acute cholecystitis was made, and operation advised.

Operation.—The operation was performed on Nov. 11 under general anæsthesia after a preliminary injection of morphia and atropine. The abdomen was opened by a right upper paramedian incision. The gall-bladder was obscured by a thick pad of injected omentum which was stripped easily, revealing a moderately distended and uniformly injected tense gall-bladder. The organ was removed without difficulty, there being no inflammatory adhesion to the liver, and no apparent disease of the adjacent part of the liver. The abdomen was closed, a drainage-tube being inserted down to the stump of the cystic duct through a stab puncture to the right of the incision.

The temperature fell to normal on the fifth day, and the pulse to 88. Thereafter the patient made an uninterrupted recovery, leaving the hospital in apparently perfect health on the twenty-first day. For twenty-four hours after the operation some bile escaped from the drainage-tube, but after this time there was no further discharge of any kind, and the tube was removed on the fifth day.

After removal, the gall-bladder was aspirated, and the fluid, which had a rancid odour, was submitted for bacteriological examination. The organ was then slit up, and found to contain from twenty to twenty-five pale faceted gall-stones, the largest about 1·5 cm. in diameter. Some of these also were forwarded under sterile conditions to the bacteriologist. Further investigation of the organ revealed slight uniform thickening of its wall, with uniform injection of the coats, but in addition the greater part of the mucous membrane had undergone gangrene in patches, the interior presenting the

appearance of a mosaic of green gangrenous areas surrounded by intensely congested but living mucosa (*Fig.* 452).

BACTERIOLOGICAL AND HISTOLOGICAL EXAMINATION.—This was carried out in the Bland-Sutton Institute of Pathology and resulted as follows :—

Fluid Contents.—The fluid was composed of thin blood-stained bile, containing a good deal of cellular débris, but only a few pus cells. It was odourless on reaching the laboratory. Gram-stained smears showed the

FIG, 452.—Gall-bladder showing gangrenous patches.

presence of large numbers of Gram-positive thick bacilli morphologically resembling *B. welchii*. Aerobic cultures in broth, on agar, and on serum agar were sterile, whilst anaerobic cultures on serum agar and in milk gave a profuse growth of an organism similar to that found in films. The culture in milk produced a typical 'stormy clot' reaction in twenty-four hours, and subcultures in various sugars gave a positive fermentation reaction in glucose, saccharose, and lactose, with no reaction in salicin. These reactions and cultural features served to identify the organism as a true *B. welchii*. The

organism had marked hæmolytic power, but no exotoxin could be demonstrated in a forty-eight hours' meat-broth culture. An intramuscular injection of bacilli into a guinea-pig produced intense gas gangrene and death within twenty-four hours.

Stones.—These proved to be composed of pure cholesterol without pigment. After repeated washings in saline several of the stones were incubated in broth, both aerobically and anaerobically. No growth was obtained in forty-eight hours in either case. The stones were then crushed and incubated again. From each of the six crushed stones *B. welchii* was obtained, and in addition, from two of them a typical *Streptococcus fæcalis.*

FIG. 453.—Polypoid mucosa and gas bubbles in muscular coat.

Gall-bladder.—A section of the wall of the gall-bladder showed extensive ulceration of the mucous membrane and an acute inflammatory reaction with polymorphonuclear infiltration extending into the muscular layers. The mucous membrane was in many places polypoid, and showed evidence of long-standing chronic inflammation. The most noticeable feature of the section was the presence of numerous clear spaces, particularly in the muscular layer (*Fig.* 453)—probably due to gas bubbles. Gram-stained films showed *B. welchii* to be numerous in the ulcerated mucous membrane, and also in fair numbers in the deeper muscular layers (*Fig.* 454).

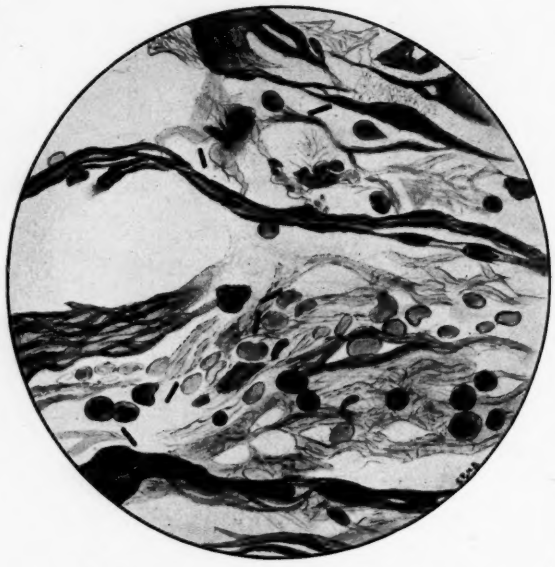

FIG. 454.—*B. welchii* in wall of gall-bladder.

The absence of pronounced toxic symptoms before operation, the uncomplicated convalescence, and the complete recovery in this case of *B. welchii* infection would appear to be due to a combination of favourable circumstances: first, inasmuch as the infection was confined to the gall-bladder, the focus was capable of complete removal by operation;

secondly, the organisms in the interior of the gall-bladder were in pure culture, i.e., not associated with a virulent strain of another organism such as a streptococcus; in addition, the previous health of the patient was good, and the strain of the organism was not one productive of exotoxins.

The presence of numerous gall-stones of some size, and the polypoid condition of the mucous membrane, suggest that inflammatory disease of the gall-bladder had been present without symptoms for some little time, and it would appear probable that the *B. welchii* invaded this already damaged organ and set up a sudden acute disease, although on this assumption it is difficult to explain the presence of this organism in all the six stones cultured after crushing. Infective conditions of the gall-bladder are almost universally caused by intestinal organisms, and in view of the frequency with which the *B. welchii* is found in the intestinal flora, it is surprising that exhaustive bacteriological studies of the gall-bladder contents have failed to detect it, except on the rarest occasions. Thus in over a thousand cases studied at the Johns Hopkins Hospital and elsewhere[1,2,5] no instance of *B. welchii* infection is reported, and the only two cases of this disease published, of which particulars are subjoined, were each looked upon as unique.

Thus in 1922 Hallé and Marquézy[3] report details of a woman of 60, previously healthy, who was seized with sudden pain in the right side, with vomiting, which subsided after a few hours. Five days later, after a purge, acute symptoms occurred and she was admitted to hospital with pain in the gall-bladder area and signs suggesting pneumonia and pleural effusion at the right base. Operation was performed under a local anæsthetic; no pus was found in the peritoneum, but six to ten lesions suggesting fat necrosis were observed in the omentum, and one of these was removed for examination. The patient's grave condition did not allow of exploration of the gall-bladder. She died four days later, and at the post-mortem the gall-bladder was found to contain blood-stained fluid and gas, but no stones. It was very adherent to the liver and surrounded by omental adhesions into which perforation had occurred. *B. welchii* was recovered from the piece of omentum removed at operation, and also from the gall-bladder, liver, and spleen, inoculation into a guinea-pig proving fatal in ten hours. Histological examination revealed the presence of the organisms in the wall of the necrotic gall-bladder, in the portal vein, and in small numbers in the lobules of the liver. The case was considered to be unique, and looked upon as a primary infection of the gall-bladder with the *B. welchii* followed by a fatal septicæmia.

In 1925 L. Kirchmayr[4] reported a case of a man of 64 who suffered from acute abdominal pain for a short time, followed by a period of freedom of fourteen days, and then a further attack of pain, on account of which he was admitted to hospital with a diagnosis of acute appendicitis. He was slightly jaundiced, the gall-bladder was palpable and tender, the liver enlarged, and a trace of bile found in the urine. At operation a gall-bladder as big as a fist and adherent to the duodenum and lesser omentum was removed. On puncture it contained a mixture of bile, blood, and gas, and a quantity of fine sand with some small stones, the largest the size of a hemp seed. A section of the gall-bladder revealed diffuse acute gangrenous inflammation with multiple old abscesses in the thickened wall. The fluid obtained from

the gall-bladder was found to contain organisms which gave the cultural tests for *B. welchii*. The patient made a satisfactory recovery, and when last seen some months after the operation was in good health, the liver enlargement having subsided.

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FRACTURES OF THE MALAR-ZYGOMATIC COMPOUND: WITH A DESCRIPTION OF A NEW X-RAY POSITION.

By H. D. GILLIES, T. POMFRET KILNER, and DUDLEY STONE, London.

Much has been written during late years about fractures of the long bones. Fractures of the bones of the face have received little or no attention. If excuses are needed for the writing of the present paper, they are to be found in the comparatively common occurrence of the fracture discussed, in the extreme scarcity of mention of it or its treatment in surgical literature, and in the fact that even well-known pathological museums do not contain a single example. Modern text-books of surgery and fractures deal with fractures of the malar-zygomatic compound so sparingly that one must be content with a few stray references or a paragraph on maxillary fractures, or be guided by a terse sentence or two covering this subject. The very considerable disability which the fracture produces, together with the unsightly deformity in facial contour, are usually not fully recognized and frequently go untreated.

Definition.—We wish to limit the present paper to a consideration of fractures met with from the auditory meatus behind to the external angular process of the frontal bone above and to the maxilla and orbit in front.

Occupying, as it does, a most prominent position amongst the bones of the face, the malar-zygomatic compound bears the brunt of resistance to violence from many directions. It is not generally realized how great a part in the protection of the eye is played by this prominence, and it is only when a number of cases of fracture of this type have been studied that it is rendered obvious to what a great extent that protection is lost, and how prone to serious injury from even such a large object as a tennis ball the eye has become.

Etiology.—Fractures in this region are always due to direct violence. They result, on the playing field, from blows with the point of the elbow or from kicks; they are produced by falls on the face; and they are especially common in motoring accidents. Our experience is contradictory to that of surgical authors who state that fractures of the malar bone are unusual.

Diagnosis.—In a typical case diagnosis may be made at sight once the characteristic appearance has been fully recognized. A peculiar facies is present, due chiefly to a certain flatness of contour and an absence of expression on the affected side. Mobility and crepitus are rare, but by careful investigation the lines of fracture may often be detected by palpation. The outstanding feature is a definite flattening of the cheek in its upper part and a fullness in its lower. This is made clearer when the area is examined from above after the traumatic effusion has subsided. Depression, as compared with the opposite side, will often amount to half an inch or more. Examination from in front, assisted by palpation, reveals abnormal irregularity in the

infra-orbital margin, above the outer canthus, and sometimes in front of the ear, where the stump of the zygomatic process of the temporal bone stands out. Palpation in the mouth reveals unnatural resistance to the finger passed along the ascending ramus of the mandible and between this and the maxilla.

At first there is much bruising and swelling, and these, as in cases of fracture of the nasal bones, mask the depression and fracture to such an extent that the underlying condition is entirely overlooked; in this way arises the necessity for late and difficult, instead of early and reasonably simple, treatment. Frequently—almost always—there is unilateral epistaxis due to damage to the mucosa of the antrum. A 'black eye' is present, together with conjunctival ecchymosis. Mastication is interfered with on account of pain produced by any attempt to use the masseter muscle, the attachments of which to the fractured and displaced bone are damaged. Mechanical obstruction to jaw movements may also be present, and is due to the pressure of indriven fragments of the zygoma on the coronoid process or the temporal muscle. Pain may be traced to damage in the region of the infra-orbital nerve, whilst from the same cause there may be numbness over the area of distribution of this nerve. The mandible usually deviates to the opposite side—a position which appears to be one of mandibular rest. Limitation of eye movements may be present where there is much interference with the floor and margin of the orbit.

Varieties of Fracture.—The malar bone represents a strong bone on fragile supports, and it is for this reason that, though the body of the bone is rarely broken, the four processes—frontal, orbital, maxillary, and zygomatic—are frequent sites of fracture. The bone is frequently separated from all its attachments and displaced *en masse*. When the anatomical position and structure of this bony element are studied, together with its susceptibility to blows from very divergent angles, it will be obvious that the lines of fracture and the displacement produced will vary in almost every case. Whilst blows at right angles to the surface produce direct depression and sometimes comminution of the body of the bone, blows from behind or from the front, from below or from above, produce sliding and tilting of the bone, and the degree of depression and displacement varies according to the direction and continuance of the force.

Four sites of fracture are found, corresponding with the points of articulation of the bone, namely: (1) Zygoma; (2) Infra-orbital foramen region—orbital process; (3) Supero-external orbital margin—frontal process; (4) Anterior wall of antrum—maxillo-malar articulation. Fracture of the infra-orbital margin occurs near its mid-point, and the inner extremity of the outer fragment may project forwards and upwards into the lower conjunctival fornix, where it can be seen and felt. The fracture line extends downwards through or near the infra-orbital foramen. Fracture in the region of articulation with the frontal bone produces an irregularity of the orbital margin in its upper and outer quadrant, whilst a similar irregularity may be palpated by the finger passed along the zygomatic arch. In cases where the swelling has already subsided these irregularities are easily seen. The mass of bone separated by these lines of fracture is usually driven into the antrum and becomes impacted there.

Complications.—Situated in a region bounded by such structures as the eye, the antrum, the nose, and the infra-orbital nerve, a fracture, with such displacement as occurs in most cases, is liable to involve some or all of these important structures. Such complications as nerve injury, eyeball injury, and involvement of the antrum or nose are quite common. In the majority of cases the anterior wall of the antrum is crushed, and a suppurating hæmatoma may result. It is essential that a careful watch be maintained for such an occurrence.

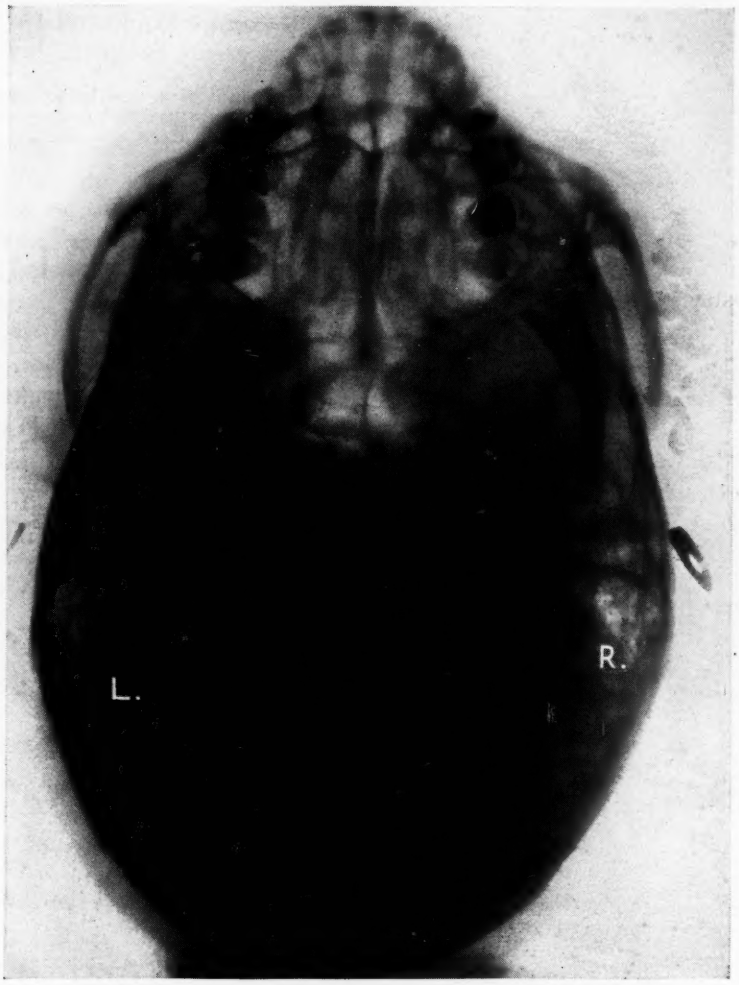

FIG. 455.—Skiagram of the normal head, not tilted, showing a supero-inferior view of the skull and the zygomatic arches.

X-ray Details (DUDLEY STONE).—Nothing is more valuable to the surgeon in determining the extent of injury and the position of the fragments—both before and after operation—than a good skiagram. To secure a satisfactory picture of the fracture a new departure in technique from methods formerly used was called for.

Supero-inferior View of the Skull.—The skiagram is taken with the tube below the couch. The patient kneels on a stool facing the couch, the elbows resting on it. An air cushion of suitable length (15 in. to 18 in.) is blown up tight, the patient leans well forward over the couch, and the cushion is placed under the chin.

FIG. 456.—Skiagram of a case before operation: fracture of left zygomatic arch; supero-inferior view of left side of the skull. Head not tilted.

Malar-zygomatic Region.—Firm supports are placed in front of the patient to the level of the top of the head. The fluorescent screen is then placed on the patient's head, and the tube box is pushed over as close to him as will allow of the rays just missing the chest. The diaphragm is then adjusted to cut out scattered radiation. The plate is placed in position. The patient is instructed to hold the breath, and the exposure is made as rapidly as possible. (*Figs.* 455–7.)

A symmetrical picture as a rule does not give the best view of the zygomatic arch; the head has to be tilted slightly, usually away from the injured side, to get the arch to stand out as clearly as possible from the head.

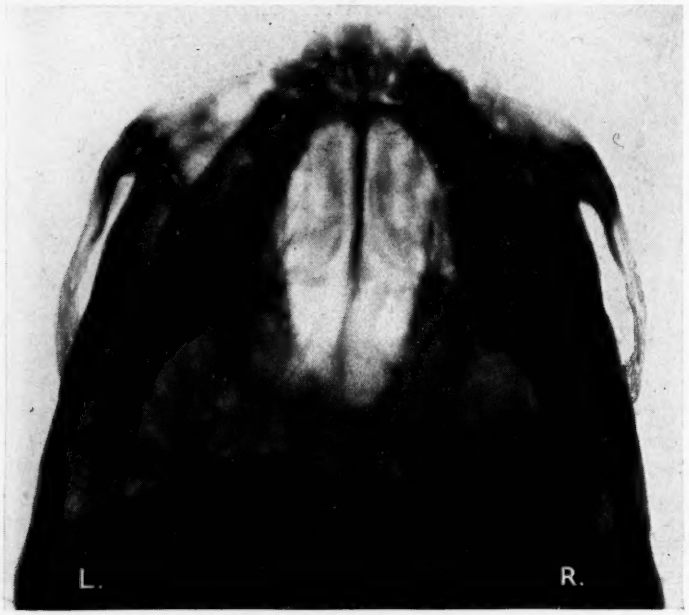

FIG. 457.—The same case as in *Fig.* 456, after operation: bones of the arch replaced. Head not tilted.

A similar technique is now employed to obtain certain views of the lower jaw, a film being gently held between the teeth of the patient. This supero-inferior view has proved instrumental in demonstrating many anatomical details of the skull hitherto hidden by superimposition.

Treatment.—The methods of treating a fractured malar bone recommended by the various writers who have reported cases include simple digital manipulation under general anæsthesia, external manipulation by means of cow-horn dental forceps grasping the edges of the bone, traction and elevation by means of wire or heavy bone elevators (Bevan, Matas) passed through small local external incisions, and elevation via an incision in the mucosa of the gingival sulcus at the canine fossa (Lothrop).

Our technique, which has now been used successfully in a number of cases, differs from those mentioned. The temporal region of the scalp is shaved, and the usual skin preparation is carried out. A curved incision, 1½ in. long, is made over the temporal muscle and well within the hair-line. The edges are retracted; a small incision is made in the temporal fascia; and a long, thin elevator is passed downwards on the surface of the temporal muscle until it lies deep to the displaced bone. When the lever is inserted in the correct fascial plane it slips under the depressed bone in a most convincing manner, while the operator's hand rests on the firm support given by the skull. The latter should be protected from local pressure injury by a large gauze pad. By careful levering movements the whole bony mass is elevated into correct position; a finger on the various points referred to previously is used as a guide to determine when this result has been achieved. (*Fig.* 458.)

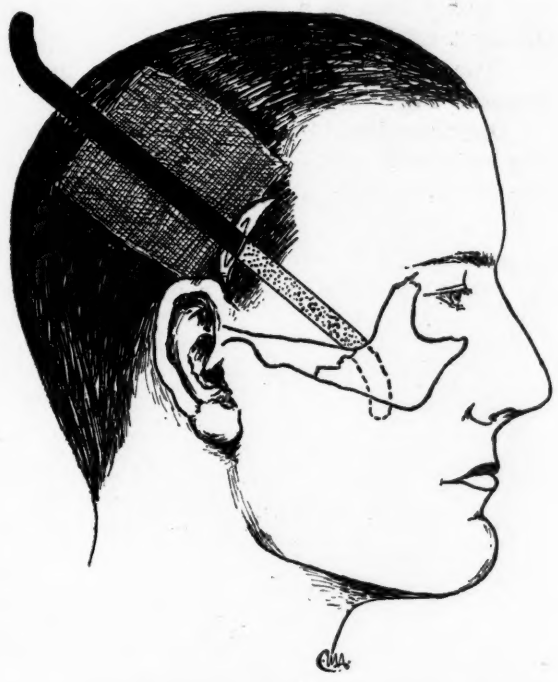

FIG. 458.—Malar-zygomatic reposition: illustration of technique.

In recent cases there is no tendency to recurrence of the displacement, for there are no serious muscular contractions to produce it. The improvement effected by the manœuvre is spectacular, and the bony mass, when thus disimpacted, is manipulated into position with ease by the combined use of the lever and the free hand. A certain amount of fixation can be obtained by a pad strapped to the face below the malar prominence.

In old neglected cases it is often necessary to cut down on individual points of fracture before the bone can be satisfactorily freed; the lines of incision required for this are frequently decided by scars already present. In most cases, however, it is possible to refracture at these points by means of a chisel or osteotome driven into the lines of fracture from the temporal incision.

Skin contraction and absorption of bone in old cases render replacement more difficult and recurrence of deformity more likely. In two of our old cases it was found necessary to wire the bone in position in the external angular process region in order to retain it in its corrected position.

Retention by intra-oral methods has proved irksome to the patient and unsatisfactory.

It is sometimes necessary to make an intrabuccal incision in order to relieve impaction in the region of the antrum. It is necessary to repeat the warning already given regarding the possibility of antral infection. Much damage may have been produced here already, and operative interference may easily lead to a lighting up of latent infection which calls for the establishment of free drainage.

The temporal incision is closed in the usual way, and no drainage is necessary.

Advantages.—The advantages of this technique are self-evident: (1) The incision is made in a region where the resultant scar is negligible. (2) The wound is far enough removed from the bruised and swollen parts for infection to be avoided. (3) The field is free from important nerves which might be injured during the operation. (4) The lines of force to be exerted in levering the bony mass into position are more easily obtained through this approach than any other.

SHORT NOTES OF RARE OR OBSCURE CASES

A CASE OF ALBERS-SCHÖNBERG'S DISEASE.

By H. R. SEAR, Sydney, N.S.W.

Albers-Schönberg's disease (*Marmorknocken*; marble bones) is an extremely rare condition; W. G. Alexander, in 1923, could find only 9 cases, 7 occurring in Germany, 2 in America. The following case is briefly recorded, as the bones show some unusual characteristics. The typical features of this disease are the extremely dense changes in all the bones, especially the ends of the diaphyses; with marked anæmia, due probably to the diminution of the medullary spaces; enlargement of the spleen and liver; pressure on the cranial nerves, with optic atrophy, nystagmus, etc.; hydrocephalus; interference with dentition; and necrosis of the jaws. This case presented all the classical features.

Fig. 459.

J. P., male, age 6 years, was referred to the Royal Alexandra Hospital for Children, Sydney, on June 22, 1926, for treatment of his mouth and jaws, which were extremely septic. He was admitted under Dr. Edgar Stephen, with whose permission I am publishing this brief account.

History.—The family history showed no evidence of any familial disease—he was the only child of an elderly primipara. The Wassermann reaction was negative, as expected. Syphilis does not appear to be the causative factor, nor do the bone changes, as determined by X rays, suggest it. At birth the child was noticed to have a peculiar-shaped head (*Fig.* 459); at the age of 12 months his head seemed to enlarge unduly. He has always been pale. The mother thinks he had always been blind, or partially so. Mentally, he appeared alert and intelligent. Five months before admission the teeth became carious;

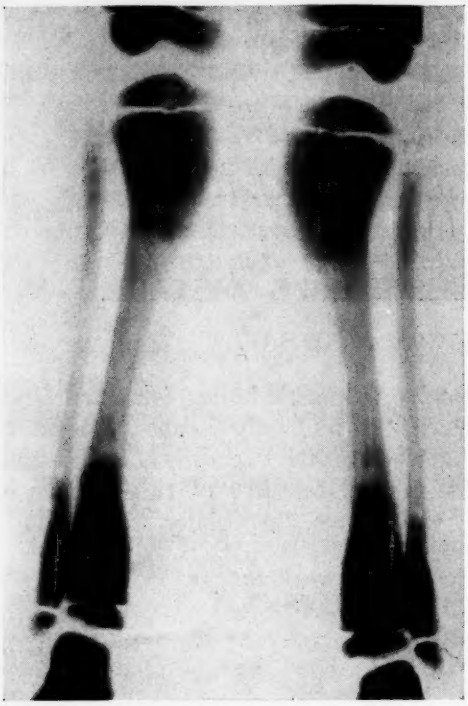

FIG. 460.—Compare with *Fig.* 461.

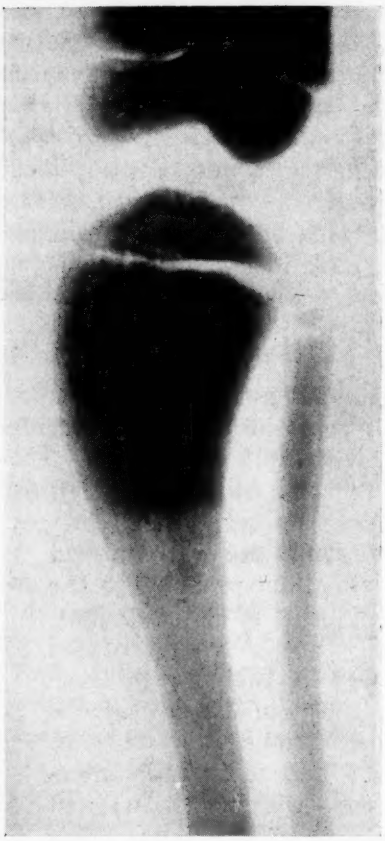

FIG. 461.—Enlarged from upper right-hand quarter of *Fig.* 460.

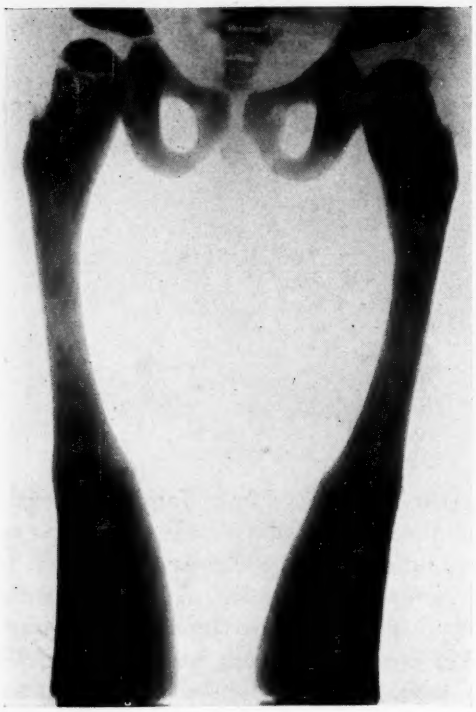

FIG. 462.

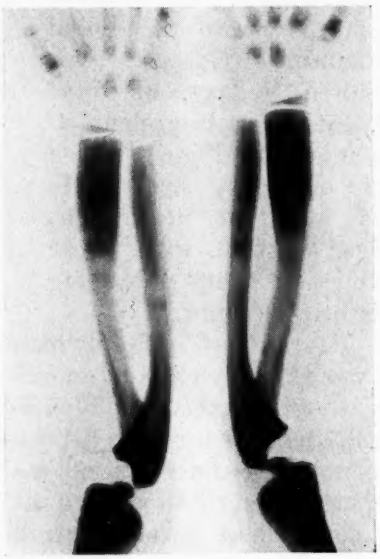

FIG. 463.—Compare with *Fig.* 467.

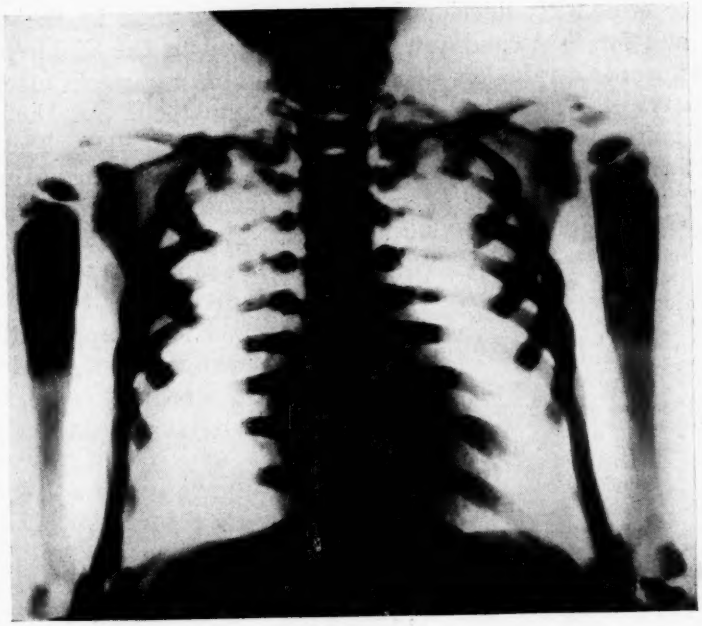

FIG. 464.

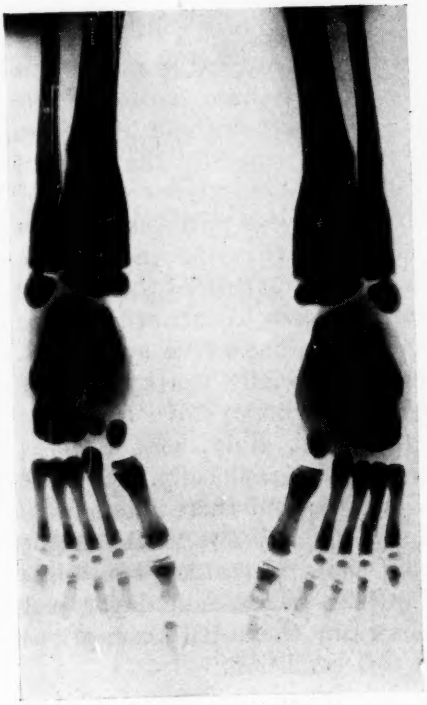

FIG. 465.

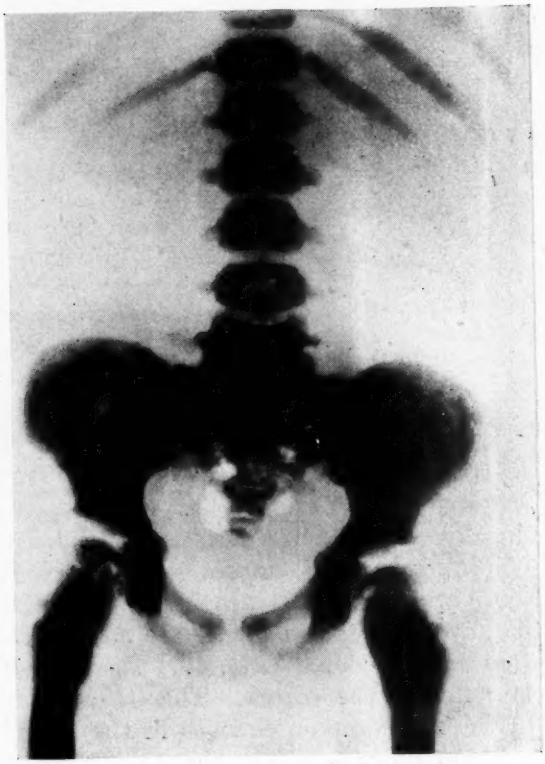

FIG. 466.

an ulcerative stomatitis developed which did not yield to the usual dental treatment, and for that condition he was referred to the Children's Hospital. A tumour appeared on the left side of the mandible two weeks after admission.

EXAMINATION.—The head was unequally enlarged, but the bony tissue had a solid uniform feel; no soft patches could be detected. The femora had a flattened feel, most marked at the lower ends. The child could walk. There was a small rounded tumour at the angle of the mandible on the left side. The liver and spleen were greatly enlarged. The child could just distinguish objects, but was unable to read. There was a bilateral divergence to the right side, and nystagmus. He appeared intelligent.

FIG. 467.—Enlarged right-hand top portion of *Fig.* 463.

The blood-count showed a marked anæmia, with a red-cell count of 1,200,000 and a colour index of 1; there was marked anisocytosis and poikilocytosis, together with nucleated reds and a few myelocytes. The white count was 9000, with a relative increase in lymphocytes. Estimations of the calcium content of the blood were made on two occasions by Dr. Tidswell, but in neither was there any departure from normal.

The child was removed from the hospital and died outside; an autopsy was refused.

The radiographic features of this disease are the generalized nature of the bony lesion; all bones without exception are involved; but especially the ends of the diaphyses for some distance from the epiphyseal lines; these parts assume an extremely dense structure—hence the name 'marble bones'. The cranial bones are involved, and this leads to narrowing of the foramina and hence the nerve symptoms.

The points especially worthy of note in this case (*see Figs.* 459–467) are: (1) Some of the bones have a curious longitudinal striation (*Fig.* 461), especially the radii, tibiæ, and femora; usually a transverse striation has been shown radiographically. (2) The epiphyses are not uniformly dense as described before; but there is a definite more transradiant centre (*see* upper tibial epiphyses). (3) The shafts of the diaphyses of the metatarsals and metacarpals show a curious hour-glass central dense area (*Fig.* 467) surrounded by a more transradiant layer just underneath the cortex. This is quite different from the usual descriptions of the radiographic changes in these bones in this condition.

For fuller details of this disease the reader is referred to a paper written by W. G. Alexander in the *American Journal of Roentgenology* for April, 1923.

TWO CASES OF CARCINOMA OF THE COLON WITH EXTENSION TO OTHER PARTS.

By E. R. FLINT, Leeds.

I saw the first case, a lady, age 43, on Oct. 29, 1926. For two months before this she had had a little loss of energy and latterly some breathlessness. Apart from this she considered herself quite well, though her friends had commented upon her loss of colour. She consulted her doctor on account of the shortness of breath, when he discovered a lump in the abdomen. On Oct. 29 she was extremely anæmic, but had no other symptoms at all. There had never been any abdominal pain, no loss of weight, no distention, no hæmorrhage, and the bowels acted regularly, the motions being of normal consistency. There was a hard lump in the region of the hepatic flexure, which I diagnosed as a growth in the upper part of the ascending colon. On Nov. 10 she was given a pint of blood by the citrate method.

Fig. 468.—Posterior view of excised specimen: showing the resected piece of duodenum on the posterior aspect of the growth.

Operation (Nov. 11).—A lump the size of a small apple was found at the hepatic flexure, firmly adherent to the second part of the duodenum. There were several enlarged glands at the lower border of the duodenum and along the course of the right colic artery, but no obvious secondary deposits anywhere. The last 6 in. of the ileum, the cæcum, ascending colon, and half the transverse colon were excised together with a large piece of the anterior and lateral walls of the duodenum and the involved lymphatic area all in one piece (*Fig.* 468). The duodenum was closed and a lateral anastomosis made between the ileum and transverse colon.

The patient made an uninterrupted recovery. A microscopic section confirmed the diagnosis, and there was so much narrowing of the lumen that it would only just take one's forefinger. The unusual features of this case

were the absolute freedom from pain, the regular action of the bowels, and the normal formation of the fæces throughout.

The anæmia, which was so profound as to be easily mistaken for the pernicious type on superficial examination, is usually seen with carcinoma in this position. This is an interesting fact; carcinoma in the left half of the colon, and indeed in any other situation, with the exception of the stomach sometimes, never produces this degree of anæmia. In type it is a secondary anæmia, and I suggest as a possible explanation that something is absorbed

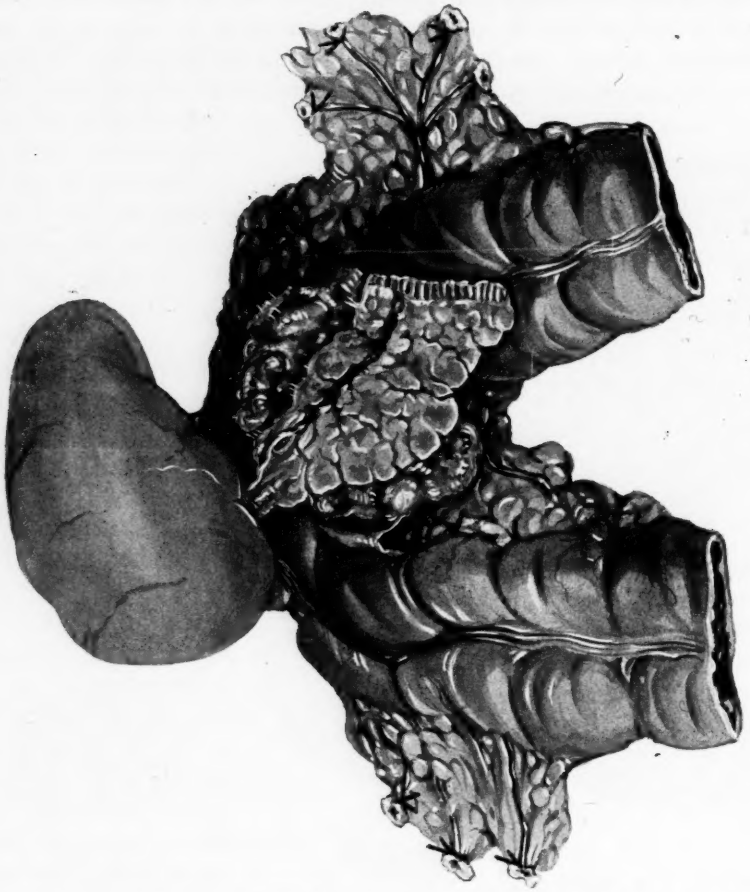

FIG. 469.—Posterior view of excised specimen: showing a part of the growth adherent to the pancreas. The larger part of the growth is on the anterior aspect of the specimen.

from the diseased colon, which, when it arrives in the liver, interferes with the re-synthesis of hæmoglobin; it may be that urobilin is normally absorbed from this region, and is altered in some way when disease exists here, so that it cannot take its proper part in the formation of hæmoglobin.

The second case was a man, age 43, seen on May 23, 1926. For three months he had had frequent attacks of colicky pain, becoming progressively more frequent and severe and accompanied by alternating constipation and

diarrhœa. On one occasion he had a threatening of complete obstruction. There had been much flatulence at times with distention of the abdomen; he had lost 3 stone in weight. There had been no obvious hæmorrhage, and he did not show marked anæmia. A fixed mass could just be felt under cover of the left costal margin. A diagnosis was made of growth in the splenic flexure.

Operation (June 1).—A large fixed lump was found at the splenic flexure as big as a tennis ball. It was adherent to the spleen and to the tail of the pancreas, but on incising the peritoneum on the outer side of the colon, it was possible to get behind the growth, and as there were few palpably enlarged glands and no secondary deposits, the whole mass was removed, taking the distal half of the transverse colon, the splenic flexure and growth, the descending colon together with the spleen and the distal third of the pancreas. A lateral anastomosis was made between the transverse colon and the sigmoid. The pancreas was crushed with a Parker's clamp and a running stitch carried round this. After slipping the clamp off, the ligature was drawn tight and the stump of the pancreas covered with omentum. Five months later the patient had put on weight and was feeling well. The bowels were acting normally and the urine was free from sugar.

At first sight this appeared to be a hopeless case, but when it was found that the growth could be raised from the posterior abdominal wall, it was thought to be worth while attempting removal, as growths in the colon are well known for their tendency to remain more or less localized for a long time.

It is not claimed, nor indeed expected, that the patient is cured, but I think his life will be prolonged and will be more comfortable, and sometimes one finds an apparently hopeless case does not develop a recurrence for a surprisingly long time. The diagnosis was confirmed microscopically, and a photograph was taken from behind which shows the spleen and pancreas (*Fig.* 469); the growth is on the anterior aspect of the specimen.

PYLORIC OBSTRUCTION IN AN INFANT FROM PRESSURE OF A DISTENDED GALL-BLADDER.

By H. H. GREENWOOD, Swindon.

J. V. C., female, age 3 months, firstborn, delivered by Cæsarean section. Healthy and normal at birth—breast-fed throughout. The child was well-nourished and in good health until she and her mother went on a visit to another town two weeks before admission to Victoria Hospital, Swindon. Without any apparent cause the child began to have attacks of acute colicky abdominal pain at intervals of two days, and appeared normal between the attacks. The pain was relieved by the vomiting of partially digested milk with some greenish bile. There was no fever, diarrhœa, or passage of blood and mucus. The mother remained well, and her milk was unchanged in amount and quality.

The child was attended by two doctors, but no diagnosis was made; she was brought home and sent into hospital the next day, Dec. 8, 1926. On

the way to hospital vomiting again occurred, the amount being so large that the child's clothes were drenched.

The child was seen to be pale, with sunken features, and extremely wasted body, crying feebly at intervals and drawing up its legs, yet it was bright-eyed and free from any appearance of toxæmia. Temperature 99°; pulse 100. Soon after entering hospital the bowels were moved naturally, the first portion being green, the main portion, however, being yellow, without any abnormal odour, mucus, or blood.

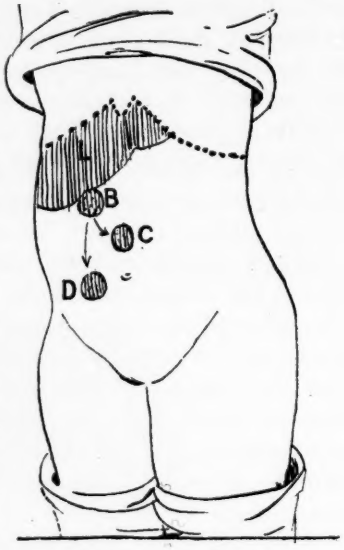

FIG. 470.—Showing extent of excursion of abdominal swelling from B to C and B to D. L is extent of liver dullness.

The stomach was distended with gas, but at no time was a peristaltic wave seen to emerge from the left costal margin and cross towards the right side. The edge of the liver could be felt some two inches below the right costal margin. Seemingly attached loosely to the liver margin, but much more mobile, was a tense hard swelling about the size of a large walnut, close under the thinned abdominal wall. This could be moved easily (*Fig.* 470) from the margin of the liver inwards as far as the middle line, and downwards to the region of McBurney's point. Running upwards and inwards could be felt obscurely a continuation of the swelling. From the purely physical examination the swelling could only be an enlarged gall-bladder, but the symptoms were more in consonance with a diagnosis of pyloric obstruction, intermittent and possibly due to a co-existing hypertrophy of the pyloric sphincter.

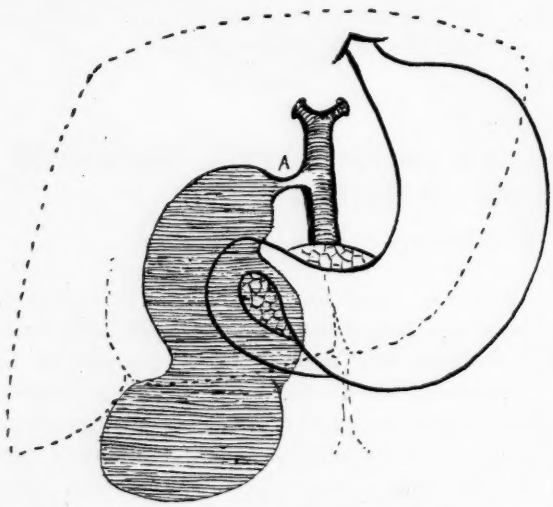

FIG. 471.—Diagrammatic figure of the parts seen at operation. A, Stenosed cystic duct.

By restricting the diet to whey by the mouth, and saline with glucose per rectum, the vomiting was arrested, but the general condition grew steadily worse, the temperature sank below normal, and by Dec. 10 (two days after admission) the pulse had risen to 140.

With the consent of the parents an exploratory laparotomy was done, and the condition detailed below (verified at autopsy) was found :—

The gall-bladder was enormously and tightly distended, so that its outline was sinuous (*Fig.* 471), the fundus projecting beyond the liver and impinging on the anterior abdominal

wall; its walls were thinned, its contents a clear watery fluid, so that the organ was translucent. The antrum lay on the second part of the duodenum, compressing it against the spine. The stomach was distended by gas, and the small bowel collapsed, empty, and thin-walled, as seen in other cases of starvation. There was a small quantity of free fluid in the abdominal cavity, serous in character.

The cystic duct was represented by an impermeable fibrous cord (*Fig.* 471). The common duct was patent, and appeared unduly large in calibre. No other abnormality was found. The bladder being incontinent no specimen of urine was examined.

Death occurred soon after the patient left the operating-table, from exhaustion due to starvation caused by pressure on the duodenum by the distended gall-bladder.

It can only remain a matter for speculation as to the possibility of the child surviving a cholecystectomy or cholecystostomy done in the earlier stages of the illness. Assuredly the operation would have proved simple, and as speedy as a Rammstedt operation for pyloric stenosis.

A CASE OF PRIMARY CARCINOMA OF THE APPENDIX.

By G. B. WOODD-WALKER, London.

J. S., age 22 years, was admitted to St. Mary's Hospital on April 8, 1926, a well-nourished, active man. The history of his complaint was as follows:—

He had suffered from three separate attacks of abdominal pain. The first was in November, 1925. He stayed in bed for four days and complained of pain in the right iliac fossa. There was no vomiting, and the pain completely passed away. The second attack in January, 1926, resembled the first in detail. The third attack was in March, 1926. This was more severe and prolonged. Acute intermittent pains of a colicky nature, chiefly in the right iliac fossa, lasted a week. The pain and tenderness were still present on admission, though less severe. There was no marked tenderness on rectal examination. A diagnosis of subacute appendicitis was made, and he was submitted to operation on April 10.

The appendix was found to be longer than normal, 5 in. (normal 3·6 in., Lockwood). The distal 2 in. were swollen and distended. At the junction of the swollen and normal portions a firm nodule could be felt, the size of a pea. There were signs of recent inflammation. Appendicectomy was performed and the wound healed uneventfully. After eight months there is no evidence of recurrence.

On opening the removed appendix (*Figs.* 472, 473) the lumen was seen to be obliterated by the firm fleshy tissue. The distal end contained clear jelly-like material. No fæcal concretions were found.

Dr. W. Newcomb, pathologist to St. Mary's Hospital, reported on the microscopical section of the appendix as follows:—

"A solid alveolar trabecular and tubular polygonal-celled carcinoma of the appendix is present. The growth is infiltrating the muscular coat and

also invading the mesentery of the appendix. The cells are large and contain more protoplasm than is usual in the so-called cancroid of the appendix. No mitotic figures have been seen. There is an increase in the submucous and subserous fibrous tissue, the result of previous inflammation." (*Fig.* 474.)

In comparing this case with recorded cases one finds much in common. Thus, in 33 cases reviewed by Rolleston and Lawrence Jones,[1] in 27 'appendicitis' was diagnosed. Raimann,[2] reporting 12 cases he collected from 10,651 appendices, states that they are 'almost always' accompanied by inflammation. As to sex incidence, Raimann finds that women are more commonly affected (75 per cent), but the evidence is inconclusive. In position the tumour is most frequently situated near the tip.

FIG. 472.—Drawing to show the macroscopic appearance of the removed appendix. Note position of the growth and the distended tip.

FIG. 473.—Drawing to show the position of the growth on the mesenteric side of the lumen.

Histologically, two types of carcinoma of the appendix are recognized. The commoner (82 per cent, Raimann) being the spheroidal-celled type, showing an alveolar arrangement, the less common being the cylindrical-celled, which resembles in age, incidence, and structure the cylindrical-celled carcinoma typical of the large intestine.

All are agreed that the prognosis after removal by appendicectomy is good, recurrences after the removal of the spheroidal-celled type being almost unknown. The cylindrical-celled type is considered by some authorities, perhaps wrongly, to be more malignant.

Recently the term 'basal-celled carcinoma' has been used to embrace

carcinoma and like growths clinically of low malignancy. In it are included rodent ulcer, parotid tumours, and cancroid growths of the small intestine, and these spheroidal-celled carcinomata of the appendix. The term 'basal-

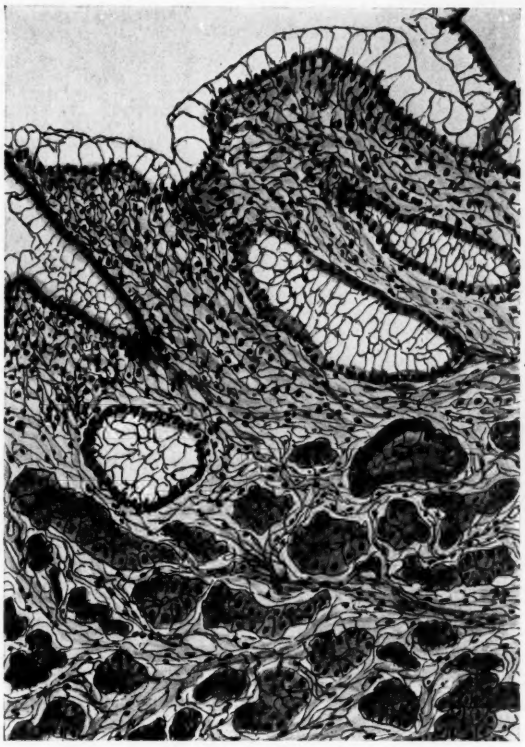

FIG. 474.—Drawing to show the microscopic appearance of the growth and the alveolar trabecular and tubular disposition of the cells.

celled' seems to have little significance, but clinically and histologically a relationship is apparent.

I am indebted to Mr. Duncan C. L. Fitzwilliams, F.R.C.S., for permission to publish this case.

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A CASE OF HYDATID DISEASE OF THE KIDNEY.

BY E. T. WILLANS, STOCKTON-ON-TEES.

WITH A PATHOLOGICAL REPORT BY M. J. STEWART, LEEDS.

THE patient, a man, age 42, came to the Out-patient Department of the Stockton and Thornaby Hospital complaining of severe pain in his left side, which had come on while he was at work. He had experienced no symptoms before.

On Examination.—The patient was found to be extremely tender and rigid over the left hypochondriac region, so tender that it was impossible to make out anything definite. He was admitted to the ward, his temperature being normal and pulse-rate 78, and was kept on fluid diet; hot fomentations were applied to the tender area. The urine contained nothing abnormal. Skiagrams showed a diffuse shadow under the last rib, but no definite diagnosis could be made. After three days the extreme tenderness subsided and a large mass could be made out which suggested a kidney tumour. Six days after admission the urine was found to contain a trace of albumin, which persisted, but no trace of blood or pus was found.

Fig. 475.—Specimen of hydatid disease of the left kidney (now in the Pathological Museum at Leeds).

Operation.—Usual loin incision. Large kidney tumour was found. The tumour was freed with considerable difficulty owing to the very dense adhesions. Nephrectomy was performed. While dividing the thickened ureter the clamp slipped and a stringy mucous mass of hydatid cysts escaped from the lower end of the ureter. The wound was cleansed and closed in layers with a small tube-drain at the posterior angle.

The kidney tumour was extremely hard in parts and felt like a calcareous kidney which had become septic, and the hydatid condition was not suspected until the typical cysts escaped from the lower end of the ureter.

Professor M. J. Stewart has kindly furnished the pathological report which follows, together with the accompanying drawing (*Fig.* 475).

Pathological Report.—

Naked-eye Examination.—The shape of the kidney is generally conserved, but the upper three-fourths of the organ is enlarged and fluctuant. On longitudinal section this part of the kidney is found to be largely replaced by a hydatid cyst measuring 4 in. × 3 in. in diameter. The wall, composed of fibrous and granulation tissue, is lined in many places by a shaggy layer of yellow necrotic and calcified material; the interior is occupied by numerous hydatid daughter cysts of various sizes. The dilated and thick-walled calyx at the otherwise healthy lower pole of the kidney also contains a daughter cyst, while others project from the cut end of the renal pelvis where it is narrowing to its isthmus.

Histological Examination.—

1. The hydatid character of the cysts is obvious from the structure of the laminated ectocyst, although neither scolices nor hooklets are present in the sections examined. Further evidence of the death of the cysts is afforded by the presence of necrotic débris, pus, and calcified material in and around the daughter cysts.

2. The wall of the main cavity is composed of an outer zone of dense fibrous tissue, a middle zone of cellular granulation tissue, and an inner lining of necrotic débris in which fragments of laminated ectocyst are readily seen. In the middle zone, in addition to fibroblasts and endothelial cells, there are great numbers of lymphocytes and plasma cells, with many eosinophil and neutrophil polymorphs. In the outer fibrous zone eosinophils strikingly predominate, with only small numbers of plasma cells and occasional lymphocytes and polymorphs. Where the granulation-tissue zone abuts on the necrotic lining layer a few foreign-body giant cells are seen.

3. The wall of the dilated calyx seen by the naked eye has its transitional epithelium still almost intact, although there is a good deal of (?) hydropic degeneration of individual cells. There is also a zone of plasma-cell infiltration of varying width immediately beneath the epithelium, with scattered lymphocytes, eosinophils, neutrophils, and endothelial cells. Outside this again there is an irregular zone of diffuse eosinophilic infiltration.

4. The renal parenchyma at the lower pole shows slight patchy fibrosis, scattered sclerotic glomeruli, and foci of lymphocytic infiltration. The tubules generally are somewhat dilated and their epithelium flattened, and the Bowman's capsules of the non-sclerosed glomeruli are much dilated and empty.

The patient made an uneventful recovery. Nothing abnormal, such as hooklets or scolices, was found in the urine, and the trace of albumin disappeared before he left hospital. No history of any attack suggesting renal colic was obtained.

ANEURYSM OF THE FEMORAL ARTERY IN A PATIENT WITH POTT'S DISEASE OF THE SPINE.*

By E. P. BROCKMAN, London.

Localized tuberculous arteritis is met with in the small arteries of the brain, lungs, and other viscera. The affection of the wall of a large artery is, however, of rare occurrence. An arteritis caused by the tubercle bacillus may commence in one of two ways, either by direct extension from tuberculous tissue in its proximity, or by the carriage of the tubercle bacillus in the blood-stream. It is agreed by all the writers that the former is the method by

* From the Orthopædic Department, St. Thomas's Hospital. Read before the British Orthopædic Association, October, 1926.

which the vessels of the lungs, brain, and viscera are as a rule affected. The latter method must be of very rare occurrence.

So far as I can discover by an examination of the literature there are very few references to the involvement of the large arteries—and these are only of the aorta—by direct extension from a lesion in the neighbourhood. S. R. Haythorn[1] quotes Weigert in 1877 as stating " that tuberculous lesions of the aorta and its main branches are exceedingly rare ". He grouped them in four general types: (1) Miliary tuberculosis of the intima; (2) Polypi of tuberculous tissue attached to the intima; (3) Tuberculosis of the wall involving the several layers; (4) Aneurysms the walls of which are composed of tuberculous tissue. It is an example of the last group which I desire to record, and, so far as I can discover, there is no previous publication of a similar case.

The patient was a boy, age 14 years, who was admitted to Pyrford for treatment of tuberculous disease of the spine in August, 1924. He was fixed upon a frame and his progress was satisfactory until January, 1926, when he began to complain of a dull ache and stiffness in the right thigh. Twelve days later he complained of an acute pain in the right femoral region.

FIG. 476.
Sketch of portion of femoral artery excised, showing the ruptured aneurysm.

ON EXAMINATION.—The patient had a well-marked swelling in this area which exhibited the following characteristics: (1) It was diffuse, i.e., it had no well-defined borders or limits; (2) There was well-marked pulsation; (3) A faint thrill was present; (4) A very obvious systolic murmur, conducted up and down the femoral artery, was present; (5) Pressure on the external iliac artery caused the pulsation, thrill, and murmur to vanish, but they returned immediately on releasing the pressure.

Pulsation in the posterior tibial arteries was equal in volume in the two legs. There was no evidence of abscess in the right iliac or femoral region. Any attempts at movement of the right thigh were painful and resisted.

There was some hesitation in making a diagnosis as to the nature of this swelling, in spite of the signs which are characteristic of an aneurysm. The boy was seen by various surgeons, including Sir George Makins, and exploratory operation was decided upon.

OPERATION.—On Feb. 2, Sir Cuthbert Wallace operated. He first exposed the external iliac artery by the retroperitoneal route, and applied a temporary ligature. The swelling in the right femoral region was then explored and a large quantity of recent blood-clot evacuated from the area in relation to the outer side of the artery. It was then seen that there was a small aneurysm which had ruptured, on the anterolateral wall of the common femoral artery close to the origin of the profunda femoris. The affected portion of the artery was removed, the artery above, the superficial femoral, and the profunda femoris being ligatured. The temporary ligature around the external iliac artery was released, and the incisions were closed in the usual way. The incision in the thigh did not heal soundly, and subsequently

broke down, discharging serum and caseous material. The skin also ulcerated, and has only recently healed.

The specimen of the artery shows a small aneurysm close to the origin of the profunda femoris which has ruptured (*Fig.* 476).

Histological examination of the wall of the sac and the artery shows the tuberculous process involving all the coats of the artery, so that it is impossible to demonstrate which coat was primarily involved. There are

FIG. 477.—Section through the wall of the aneurysm showing typical tuberculous inflammation, giant cell, area of caseation, and small round-cell infiltration.

many large giant cells present, with endothelial cells and small round cells, also areas of caseation (*Fig.* 477). I have examined many sections for the tubercle bacillus but have not found it.

The tissues in the proximity to the artery appeared to be quite healthy, and I would suggest that the tubercle bacillus was carried in the blood-stream from some other focus, lodged in the vasa vasorum, and produced the disease of the arterial wall.

REFERENCE.

[1] HAYTHORN, S. R., *Jour. Amer. Med. Assoc.*, 1913, lx, 1413.

A CASE OF LUMBAR HERNIA.

By HAROLD EDWARDS, London.

Although the possibility of herniation occurring in the lumbar region is well known to the student of anatomy, the condition is in effect a very rare one for the surgeon to meet. The following case occurred recently in the Surgical Clinic of King's College Hospital, and I am indebted to Mr. Arthur Edmunds, under whose care the patient was, for permission to publish this record.

History.—E. G., age 19 years, first attended the Out-patient Department of the Hospital in December, 1925. He then stated that twelve months ago he felt a pain in the right loin after a hard day's work. His occupation is that of a plater's assistant, which consists of grinding and polishing nickel plates, and involves lifting and carrying heavy cast-iron boxes, which require his full strength to move. He noticed a lump in the right loin at the time he had the pain. It was not big, and disappeared after a few days. It hurt him on coughing.

Fig. 478.—The diagram shows the site and relative size of the hernia with the patient erect.

Nothing further was noticed until December, 1925, when the pain recurred towards the end of a day's work. On that particular day he had not done any heavy lifting. It was on the day following the onset of the pain that he attended hospital, when a swelling was seen in the right lumbar region.

On Admission.—The patient was admitted into a surgical ward on Jan. 20. He was a well-built, muscular boy of medium height, and had never suffered any serious illness. A well-defined swelling, 2 in. × 1 in., presented just above the iliac crest, $2\frac{1}{2}$ in. from the posterior superior iliac spine (*Fig.* 478). The swelling was soft, not attached to the skin, and reducible on firm pressure. An impulse was felt on coughing, but it was not expansile. A diagnosis of fatty hernia was made, and operation performed.

Operation.—Under the anæsthetic, and with the patient recumbent, the lump had practically disappeared. A crescentic flap of skin with the base forwards was dissected up over the swelling, and the latissimus dorsi and external oblique muscles were exposed at their attachment to the iliac crest. The two attachments approximated very closely, and there was no 'Petit's triangle'.

The latissimus dorsi was partially cut through near its iliac origin and reflected. The condition represented in *Fig.* 479 was now seen. The posterior border of the internal oblique muscle and the free border of the erector spinæ muscle met at an acute angle above the iliac crest. Between the two, and on a deeper plane, ran the horizontal fibres of the transversalis aponeurosis, which latter structure was rendered prominent by the subjacent swelling. The swelling thus occupied the angle formed by the internal oblique and erector spinæ muscles, which represented the lower part of the space described

by Grynfelt and Lesshalft. The twelfth nerve crossed the space over the most prominent part of the swelling, emerging from underneath the erector spinæ muscle to pass deep to the internal oblique muscle. The aponeurosis covering the swelling was thick and granular, and was at first thought to be granulation tissue. Microscopic section of a portion removed showed, however, that it consisted of dense fibrous tissue, fatty tissue, and some striped muscle.

After retracting the twelfth nerve the aponeurosis was incised in the direction of its fibres, and on dissecting through the transversalis fascia a lobulated fatty tumour presented. This was drawn into the wound and with it a knuckle of large intestine to which the former was firmly adherent (*Fig.* 480). The large intestine withdrawn was a portion of the ascending colon.

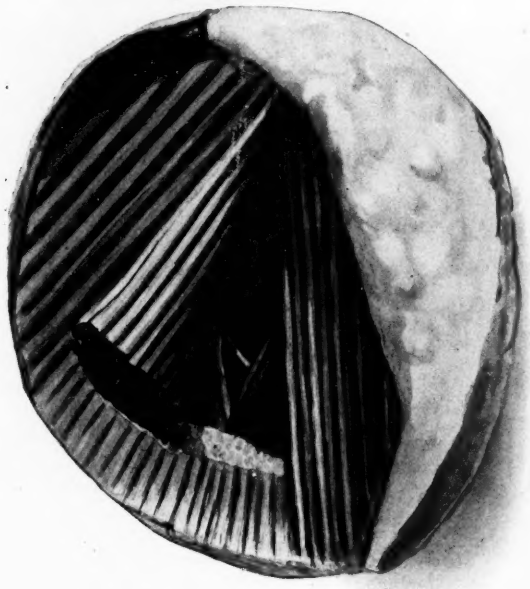

Fig. 479.—The skin-flap has been raised, and the latissimus dorsi cut through near its origin from the iliac crest, and reflected away from the posterior free edge of the external oblique muscle. It will be seen that there was no 'Petit's triangle'. The reflection of the latissimus dorsi exposes the border of the erector spinæ and internal oblique muscles as they converge to and form the apex of the upper lumbar triangle. The floor of the triangle, which is crossed by the twelfth nerve, is formed by the transversalis fascia, which in this region is pushed up into prominence by the subjacent hernia.

The hernia owned no sac—in fact, peritoneum was not exposed at any stage of the operation. The fatty tumour was dissected off the gut and removed, and the gut returned to the abdomen. The incision in the aponeurosis was sutured, and, after exsecting a portion of the twelfth nerve to avoid the possibility of its being involved in scar tissue and causing trouble in the future, the latissimus dorsi muscle was repaired and the skin incision closed.

'Grynfelt's space', through which the hernia occurred, was first described by Grynfelt in 1866. He called it the 'upper lumbar triangle' to distinguish it from the 'lower lumbar triangle' of Petit. The triangle is bounded above by the last rib and the lowest digitation of the serratus posticus inferior, in

front by the internal oblique muscle, and behind by the erector spinæ. It varies in shape, and may be triangular, deltoid, polyhedroid, or rhomboid. This variation in shape depends upon the size of the last rib, and the extent of the attachment to the latter of the serratus posticus inferior.

Watson collected 115 cases of lumbar hernia from the literature, including all types. Of these, 30 were through Grynfelt's triangle and 30 through the triangle of Petit; so that from the standpoint of the occurrence of hernia the little-known 'upper lumbar triangle' is at least as important as the more

FIG. 480.—The transversalis aponeurosis and fascia have been incised and the hernia exposed. It consists of a fatty mass attached to the posterior wall of the ascending colon, a portion of which has been drawn up into the wound.

widely recognized 'lower lumbar triangle' of Petit. Furthermore, according to Goodman and Spese, Grynfelt's triangle is more constant in occurrence than Petit's triangle (93 per cent as opposed to 63½ per cent), and has thus a definite claim to a wider recognition by both surgeons and anatomists.

The accompanying illustrations were reproduced by Mr. Edmunds from sketches made at the time of the operation.

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A CASE SHOWING ANATOMICAL AND FUNCTIONAL REPRODUCTION OF A METACARPAL BY A BONE-GRAFT.

By ANDREW FOWLER, Aberdeen.

A female patient, A. F., age 12 years, came to me with a small swelling on the back of the left hand of about five months' duration. It was situated between the fourth and fifth metacarpal bones about half an inch from the metacarpophalangeal joint. It was hard, tender on pressure, and definitely attached to bone.

A skiagram (*Fig.* 481) showed a tumour growing from the radial side of

Fig. 481.—Tumour growing from radial side of fifth metacarpal bone.

Fig. 482.—Condition one month after operation.

the fifth metacarpal bone. It had the appearance of an osteochondroma, but the fan-like distribution of new bone made one suspicious of sarcoma. It was decided to remove the whole metacarpal bone with the tumour intact. Resection, including the periosteum, was done on April 7, 1924. As the prop for the fifth digit had now been removed, a graft with periosteum was cut from the tibia by an Albee motor saw. The graft was slightly rounded at the distal end and the carpus rawed with a gouge to receive the proximal end. When in position the graft fitted tightly between the carpus and the base of the proximal phalanx. Fixation of the graft was obtained by stitching the

muscles over it with No. 2 plain catgut. The hand was put up on a cocked-up plaster splint with the fingers in a semiflexed position. Passive movement was carried out on the sixth day after operation, and from then onwards the patient was encouraged to perform gentle active movements. Microscopic examination showed the tumour to be an osteochondroma.

Fig. 482, taken one month after operation, shows a suggestion of eburnation at the distal end of the graft. *Fig.* 483, taken one year after operation, shows a definite increase in size of the head evidently at the expense of the shaft, while *Fig.* 484, which was taken at two years six months, shows a well-formed head fitting into the base of the proximal phalanx ; the graft is strong

FIG. 483.—One year after operation.

FIG. 484.—Two and a half years after operation.

and has lost the ragged appearance shown in the first skiagram. The joint line is now well seen.

The function of the finger is as follows : Extension is full, flexion is three-quarters normal, and abduction full. The patient is able to play octaves on the piano. The little finger is somewhat shorter than that of the other hand, but not noticeably so.

In the treatment of this case three points are worthy of comment. First, the graft was fixed by muscle sutures only ; second, the articular surface of the unciform was removed to allow of bony union with the graft ; and, third, active and passive movements were commenced early.

RADIUM CARCINOMA OF THE THUMB.

By CECIL P. G. WAKELEY, London.

Although many cases have been described of cancer due to prolonged exposure to X rays, practically none have been recorded which were the result of continued exposure to radium salts. I feel sure that cases similar to my own have occurred but have not been reported. The history of the case is as follows :—

Mr. G., age 65, had been handling radium salts continuously since 1904. About the year 1913 he noticed for the first time a little roughness of the hands, and at the same time he experienced a tingling sensation in the fingers. During the Great War (1914–18) a considerable increase in the amount of radium salts passed through his hands, with the result that in 1916 his hands became discoloured, and his nails began to fissure and become very friable. Warts first appeared on the dorsum of the hands in 1920, and gradually increased in number. In 1923 the skin of both hands was seen to be atrophic, thin, dry, and wrinkled; there were numerous small patches of lightish-brown pigmentation scattered about on the dorsum of the digits. The nails were thinned, striated, fissured, and brittle. The nail-bed at its free edge was markedly thickened. In September, 1923, a small wart was excised from the back of the third digit of the left hand; microscopically, this was found to consist of chronic inflammatory tissue, together with very early squamous-celled carcinoma. (Illustrations of the condition in 1923 are to be found in my Arris and Gale Lecture.[1])

Fig 485.—Showing carcinoma on the inner side of the thumb.

Fig. 486.—Section of growth showing typical squamous-celled carcinoma.

The patient was advised not to touch any more radium; but he persisted in his research work, and came under observation again in May, 1924, with a large fungating

malignant growth of the right thumb. The thumb was amputated in May, 1924, and the wound healed well.

The specimen (*Fig.* 485), which is now in the Museum of the Royal College of Surgeons (No. 1871.5), shows a large raised fungating growth on the inner side of the right thumb. The nail is fissured and striated. The microscopical examination proved the condition to be a typical squamous-celled carcinoma (*Fig.* 486).

This case is of interest because it is perhaps the first case of cancer in a radium worker, and because the patient was seen off and on ever since he first noticed pigmentation in his fingers. When the carcinoma did develop, it grew very rapidly.

It is interesting to note that Mrs. G., who helped her husband in some of his radium work, and often sat and talked to him in his laboratory, died of carcinoma of the bladder. She was admitted to hospital and partial cystectomy was performed, but the growth recurred and proved fatal.

REFERENCE.

[1] WAKELEY, C. P. G., *Brit. Jour. Surg.*, 1924, xii, 137.

FOREIGN BODIES IN THE ILEAL (MECKEL'S) DIVERTICULUM, WITH FORMATION OF A PEDUNCULATED CYST WHICH STRANGULATED A LOOP OF SMALL INTESTINE.

BY HUGH MILLER, EDINBURGH.

A MALE patient, age 35 years, was admitted to Edinburgh Royal Infirmary at 1 a.m. on May 7, 1926, with the following history:—

HISTORY.—He was a ship-breaker by trade and accustomed to arduous work. Since the end of 1923 he had suffered from attacks of abdominal pain and discomfort, and had experienced 'dragging pains in the stomach', especially while stooping at his work. On the afternoon before admission, when he was lifting some heavy material from the ground, he felt severe pain in the umbilical and epigastric regions of the abdomen. The pain was agonizing for a few minutes and then passed away, but similar attacks came on at intervals, becoming more severe and more frequent. He reached home in a collapsed condition one and a half hours later. Soon after, vomiting occurred, and this was repeated several times. The bowels did not move. He was seen by a doctor and removed to hospital at midnight.

ON EXAMINATION.—The patient appeared a strong, well-built man. He was obviously suffering with severe spasms of pain which passed across the abdomen, but were worst about the umbilicus. On palpating the abdomen, tenderness was found to be present in the left epigastrium, umbilical region, and right iliac fossa, and there was slight rigidity on pressure of both rectus muscles. He was vomiting bile-stained material. The pulse-rate was 80 per minute, respirations were 24 per minute, and the temperature 99°.

He stated that he was living under healthy conditions as regards housing,

work, and food. His appetite was good and he was particularly fond of sweets and fruit, especially tomatoes, oranges, grapes, and raisins, sometimes having six to ten oranges in a day.

DIAGNOSIS.—The condition was diagnosed as being acute intestinal obstruction, the cause being obscure, and immediate operation was decided upon.

OPERATION.—Cœliotomy was performed, the abdomen being opened by an incision through the right rectus sheath in its lower part. There was clear free fluid within the abdominal cavity, and distended loops of small intestine were at once seen. Then there presented a firm, lobulated cystic mass the size of a duck's egg. On trying to pull this out at the wound, it was found that the mass was attached by a pedicle $3\frac{1}{2}$ in. long. The pedicle passed down to the left side of, and then behind, a loop of small intestine and its mesentery, which were thus being strangulated. The condition found is represented in *Fig.* 487. When the loop of small intestine had been pulled up the base of the pedicle was exposed. The structure was then seen to be a diverticulum of bowel coming off the antimesenteric border of the ileum, just distal to the strangulated loop and two feet proximal to the ileocæcal valve. The loop was very congested, especially at its constricted neck, but was quite viable; the small intestine proximal to it was distended, while that on the distal side was narrow and collapsed. When the diverticulum was freed its pedicle retracted to 2 in. in length. Pressing the terminal cystic swelling could not force its contents along the diverticulum into the ileum. The diverticulum was clamped near its commencement and removed, the opening in the ileum being closed by two layers of sutures running in the transverse axis of the bowel.

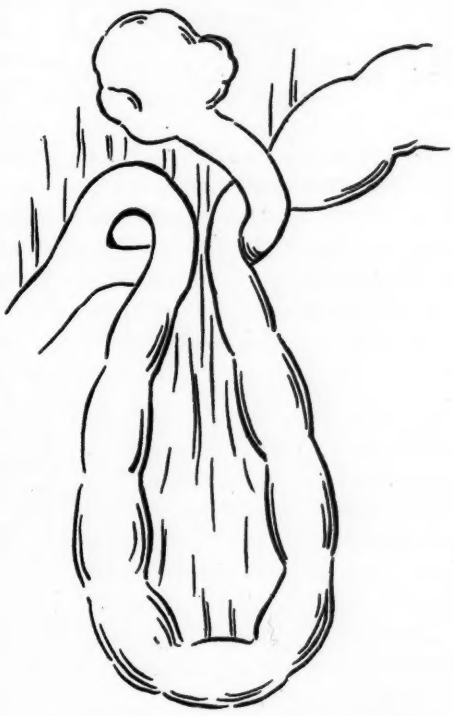

FIG. 487.—Diagram to show the way in which the loop of intestine was strangulated by the pedicle of the diverticulum.

The patient made an uneventful recovery, and left hospital, cured, three weeks later.

PATHOLOGY.—When removed the diverticulum had the appearance shown in *Fig.* 488. There were two distinct parts. The proximal part, or pedicle, was similar in structure to the ileum. As one passed a finger along the lumen a partition was felt stretching entirely across it at the level of a slight constriction which showed on the peritoneal surface. Beyond this was the distended mass which had first presented itself at the operation. It was smooth and red-blue in colour on the surface, and no evidence of acute inflammation was present. There was

no sign of a mesentery, or of a terminal band or adhesion between the mass and any other structure. The contents felt of fluid consistency.

FIG. 488.—The diverticulum removed, showing its two parts.

The specimen was cut open longitudinally; the cystic space was found to contain clear, colourless fluid like thin mucus, and very numerous small dark-coloured foreign bodies. A sketch of the diverticulum laid open is shown in *Fig.* 489. The main cyst was irregular in shape, and communicated by a small opening with another space also packed with foreign bodies. The diaphragm closing the cyst off from the patent part had mucous membrane lining both of its surfaces. The wall of the cyst consisted of much thinned-out intestinal wall with a few small fatty collections on its peritoneal surface.

A microscopic examination of a piece of the cyst was made by Dr. James Davidson, of the Pathology Department, University of Edinburgh, to whom I am indebted for this report :—

"The tissue examined shows mucous-secreting glands and epithelium resembling that of the small intestine, but on the whole the wall is thinner than that of the normal gut. Chronic inflammatory reaction is present. There is no pancreatic tissue or any evidence of malignancy".

The foreign bodies were found to be seeds and other little pieces of vegetable débris —namely: 117 tomato seeds, 29 grape seeds, 10 odd shreds of husks, 1 orange pip.

FIG. 489.—Showing the diverticulum laid open and exposing its accumulation of foreign bodies.

CONCLUSION.

From a consideration of the history and the pathological findings in this case the following appears to be the likely sequence of events. The patient from birth had a Meckel's diverticulum—a short intestinal processus from the ileum, due to non-obliteration of the fœtal vitelline duct in its proximal part. This, communicating with the ileum, received intestinal contents from it. One of the folds (plica circularis) of mucous membrane became enlarged and formed a valve partially shutting off the distal portion of the diverticulum, and in this part seeds, etc., were held up. As the result of irritation and subsequent inflammation the free edge of the plica gradually attached itself to the wall of the diverticulum opposite it, until the distal portion was completely separated from the rest. This portion then became distended with secretion from the glands in the mucous membrane to the size and shape in which it was found. The weight of the distended sac caused the proximal part of the diverticulum to become stretched into the form of a pedicle, and by means of it, dragging on the ileum and mesentery resulted. This would account for the discomfort and 'dragging pains in the stomach' which the patient had complained of during the last few years. The sudden onset of his acute symptoms was produced by the pedunculated mass being swung round behind a loop of small intestine and then falling over it to the right, so as to 'snare' it, thus giving rise to acute obstruction.

The diverticulum which I have described presents some unusual features. Foreign bodies are frequently discovered in Meckel's diverticula, but this case is remarkable on account of the large number of foreign bodies (fruit seeds), and also the manner in which they were segregated. Cysts, too, are sometimes present in connection with Meckel's diverticula. These are considered to be *embryonic* in origin, being derived from rudimentary portions of the vitelline duct; but the cyst in my case was an *acquired* one, produced by the terminal part of the diverticulum becoming shut off during life. I do not think such a variety has been previously described. The way in which strangulation of the bowel occurred is also of interest. A common factor in causing this is a remnant of the vitelline duct forming a fibrous band between the distal end of the diverticulum and the abdominal wall. No such band was present, however, and the strangulation was brought about by the peculiar nature of the diverticulum itself, in the manner shown.

I wish to express my indebtedness to Mr. George Chiene, F.R.C.S., in whose wards the patient was treated, for helpful advice in writing this case, and for permission to publish the notes.

REVIEWS AND NOTICES OF BOOKS.

Manual of Surgery. By the late ALEXIS THOMSON, M.D., F.R.C.S. (Ed. and Eng.), Professor of Surgery, University of Edinburgh, and ALEXANDER MILES, M.D., LL.D., F.R.C.S. (Ed.), Consulting Surgeon, Royal Infirmary, Edinburgh. Seventh edition. Vol. III, Thorax and Abdomen. Crown 8vo. Pp. 567, with 169 illustrations. 1926. London: Oxford University Press. 12s. 6d.

THE fact that this well-known text-book is no longer small or short is shown by the size of the present volume, which deals only with the thorax and abdomen. It is, of course, filled with sound fact and excellent illustration from the first page to the last. Probably the authors, if they had foreseen the size to which their work would grow, would have used a larger page, and it is certainly a drawback that so many of the reading pages are cut up by the figures. The profuse clinical illustrations alone make the book worth getting, but when considered in relation to the needs of the text, we find that they deal too much with unusual conditions—for example, hypertrophy of the breasts or diverticula of the small intestines—and too little with matters of everyday importance—the X-ray appearance of gastric ulcer or growth, for instance.

There are a few important points in diagnosis and treatment which we think might have been included. The radiographic findings in gastric and duodenal ulcers are described very inadequately. In the case of gastric ulcer the characteristic spasm opposite to the crater is not mentioned, nor is the deformity of the duodenal cap in duodenal ulceration. In the treatment of acute peritonitis and appendicitis the possibility of treating ileus by a short-circuiting operation is not mentioned. In the sections on renal and prostatic disease the most simple and useful test of renal efficiency, namely, the urea-concentration test, is omitted.

A Shorter Surgery: A Practical Manual for Senior Students. By R. J. MCNEILL LOVE, M.B., M.S. (Lond.), F.R.C.S. (Eng.), First Surgical Assistant, London Hospital. Demy 8vo. Pp. 298 + viii, with 43 illustrations and 13 plates. 1926. London: H. K. Lewis & Co. Ltd. 12s. 6d. net.

IT is difficult to understand what are the scope and object of this book. In the preface it claims to be a sort of companion to the larger text-books, but it is not evident whether it is intended to be used as an introduction or as a 'refresher'. That there is a great deal of sound information clearly imparted almost goes without saying, as the book is written by an active teacher of the London Hospital; but it is so unequal in its dealing with surgical problems that it cannot be a guide for the ordinary student. For example, the routine treatment of fractures is not mentioned, although such conditions as the so-called diseases named after Köhler, Schlatter, Osgood, and Madelung are shortly described. The operation for meningeal hæmorrhage is described in detail, but there is no account of the general method of examining the abdomen in acute conditions. Similarly in the illustrations a good photograph of a hand in syringomyelia is given, but there is no picture of any of the common deformities.

Surgical Applied Anatomy. By the late Sir FREDERICK TREVES, Bart., revised by C. C. CHOYCE, C.M.G., C.B.E., etc., Professor of Surgery, University of London, etc. Eighth Edition. F'cap 8vo. Pp. 727 + x, with 162 illustrations, including 66 in colour. 1926. London: Cassell & Co. Ltd. 14s. net.

ONE turns over the pages of so old a friend in a spirit of pleasant recollection and apprehensive doubt, delighted to be able to recall some paragraph or figure which has been useful, yet fearful that one may no longer find one of those delightful narratives—one had almost said fairy tales—which are often the best remembered features of this kind of book. In this edition we miss some treasures of our youth, but much has been added in an endeavour to bring the volume up to modern practice and thought. It has owed a great deal to the wide scientific knowledge of its former editor, Sir Arthur Keith; in his hands its anatomy was made accurate, and much of value in the field of comparative anatomy was included. Its new editor is to be congratulated on being privileged to follow two such gifted predecessors; this edition bears evidence that he has begun his work extremely well.

The centres around which surgical thought revolves have greatly changed since Treves wrote this book in 1883, and revision must be along the lines of modern surgery, difficult though it must prove to be. There are many quotations of little value by authors who, even to the present writer, are only a name, and who to the modern student must be quite unknown. These should give room for larger chapters on the anatomy of the chest and sympathetic nerve system which recent surgical advance has rendered necessary.

The diagrams are on the whole well designed, but several of the cross-sections scarcely justify in value the space they occupy.

La Pratique chirurgicale illustrée. By VICTOR PAUCHET. Fasc. X. Royal 8vo. Pp. 250, with 235 illustrations by S. DUPRET. 1927. Paris: Gaston Doin et Cie. 7s. 6d.

IN this volume Victor Pauchet describes an ingenious operation for enucleation of a lingual goitre. He employs local anæsthesia and a preliminary tracheotomy. A longitudinal incision just above and parallel to the hyoid bone is used, and the prelingual muscles are divided. A short left lateral vertical incision is then made, the inferior constrictor divided, and the pharynx opened. Through this opening the pharynx is rendered anæsthetic with gauze soaked in cocaine solution. The goitre is then aspirated through the mid-point of the first incision, and the hyoid muscles are divided until the goitre is reached; this is enucleated with the finger after the method of prostatectomy. A note of warning is sounded of the possible absence of both thyroid and parathyroids in the neck and the risk of myxœdema and tetany.

The indications for cholecystostomy and cholecystectomy are fully discussed, and in a summary Pauchet states that after having performed a great many cholecystectomies even in acute cases he has now 'sobered down' and performs cholecystostomy more often than he used to do.

In dealing with various forms of gastro-enterostomy, anastomosis with Jaboulay's button without any accessory sutures is fully described. Its use is recommended in some cases of inoperable carcinoma, and as a preliminary to partial gastrectomy. Amongst other indications for the use of the button Pauchet considers that the anastomotic opening is less liable to invasion with growth and that the operation involves a minimum of surgical manipulation in cases complicated by adhesions. The indications for partial gastrectomy in two stages are dealt with thoroughly and are most beautifully illustrated. Total gastrectomy is advocated only when circumstances render it alike unavoidable and at the same time reasonably possible.

The method of introducing radium needles into a rectal growth after exposure from behind which Dr. Neumann, of Brussels, originated and has described as the barrage method is most clearly illustrated.

The articles on the operative treatment of hydatids of the liver and abscess of

the liver by Drs. Pierre Mornand and Le Roy Des Barres respectively follow more or less conventional lines. Both are good and vividly portrayed.

Professor Léon Bérard contributes a very interesting article on resection of one phrenic nerve to produce hemiparalysis of the diaphragm and pulmonary collapse in the treatment of tuberculosis of the lung. He also employs the operation as a supplement to artificial pneumothorax when this has proved inadequate, and as a preliminary to certain plastic operations on the thorax. Professor Bérard has performed this operation fifty-eight times, and there have been no gastric or cardio-vascular complications.

The volume concludes with a good description of the operative treatment of injuries to the semilunar cartilages by Professor Tavernier, who, in operating on the internal cartilages, employs a long transverse incision and deliberately divides the internal lateral ligament to secure complete exposure of the whole meniscus.

The high standard of cinematographic illustrations which M. Dupret has established in previous volumes is well maintained throughout.

Die Chirurgie: A System of Surgery. Edited by Professor KIRSCHNER (Königsberg) and Professor O. NORDMANN (Berlin). To be completed in six volumes. Fasc. 12, Part 2 of Vol. IV. Imperial 8vo. Pp. 274, illustrated. 1926. Berlin: Urban & Schwarzenberg. M. 20.

THIS is a paper-covered volume, being a small part only of a large text-book of surgery which is appearing in instalments. The contents of this number include: "The Surgery of the Œsophagus", by Professor Schmerz, of Grez, and "The Surgery of the Mediastinum", by Professor Wendel, of Magdeburg. Perhaps the most striking feature is the section in which the various methods that have been devised for making an artificial œsophagus have been gathered together and described. Otherwise the book is written on the conventional lines of most text-books.

Lehrbuch der speziellen Chirurgie, für Studierende und Aerzte. Edited by Professor HOCHENEGG (Vienna) and Professor PAYR (Leipsig), with the collaboration of twenty-four other surgical specialists. Second edition. Volume I in two parts. Pp. 1244, with 527 illustrations. 1927. Berlin and Vienna: Urban & Schwarzenberg. M. 36.

THE first volume of this large text-book deals with the head and neck; chest and breast; and the vertebral column and pelvis. The section on the skull and its contents by Payr and Sonntag is in many respects one of the best in the volume, particularly in regard to the many excellent coloured figures and diagrams illustrating the circulation in the skull and brain and the description of the pathology of general head injuries. There is also a good account of various methods of opening the skull and of cranial plastic surgery. The description of plastic face surgery and that on cleft-palate are very inadequate. The sections on special subjects, e.g., the nose and teeth and ear, do not seem to us to be as complete as one would expect in a work of this size and character.

The section on the mouth and tongue (Hochenegg and Harmer) is, like so much of this book, curiously unequal in its description of rare and common diseases. Thus the uncommon affections, e.g., macroglossia, angioma, and papilloma of the tongue, are described and illustrated fully, whereas epithelioma of the tongue is dealt with in two pages without a single illustration. The section on diseases of the jaws (Gnezda) gives a good account of the new growths and inflammatory conditions and of the various operative procedures for excision of the upper or lower jaw, but the account of bone-grafting for defects of the mandible is much too brief to be of any practical value.

The section on the thyroid gland (Payr and Ladwig) is complete and well illustrated, especially in regard to the X-ray appearances of the trachea in the different

forms of goitre. Diseases of the œsophagus are described by Heynowsky, and there is a good account of the various forms of stenosis and dilatation of the gullet with the X-ray appearance of each. The section on thoracic surgery (Kleinschmitt) is full and complete in regard to the inflammatory affections of the pleura and their treatment, but the important subject of mediastinal tumours receives very short notice. The concluding section of this volume are chiefly notable for the excellent articles on scoliosis (Lorenz and Hass) and on spinal tuberculosis (Hass).

Operative Frakturenbehandlung. By Dr. RUDOLF DEMEL, Assistant in the Surgical Clinic of Vienna. Medium 8vo. Pp. 227 + viii, illustrated. 1926. Vienna: Julius Springer. Bound, 31s. 6d.; unbound, 28s.

DURING the year 1924 and the first half of 1925, 1400 fractures were treated in v. Eiselsberg's clinic; of these 77 were dealt with by open operation, and this material is the basis of the work in question. Of the methods employed the most common was fixation by wire, to which the use of Lambotte's bands was the most favoured alternative, while Lane's plates were used only in two cases. In more than a quarter of the cases reposition by open operation without any internal splint was employed.

For wiring fractures special instruments have been introduced, and a large proportion of the book deals with the technique and the results of wiring after the method of the clinic. This follows the old-established plan of encircling the bone with one or more loops of wire; this is obviously limited in its use to oblique fractures of the long bones and to such fractures as those of the patella and lower jaw; at the best no more than partial immobilization is obtained.

The radiograms, which are poorly reproduced, suggest that not a high level of anatomical accuracy is obtained by the methods employed, but some figures show good functional results. The different operations which have been introduced for the treatment of fractures are briefly reviewed in the comprehensive manner which one would expect of an author working under Eiselsberg, and a most complete bibliography is included.

Etudes sur les Affections de la Colonne vertébrale. By ANDRÉ LÉRI, Faculty of Medicine of Paris. Preface by PIERRE MARIE. Medium 8vo. Pp. 526, with 115 illustrations. 1926. Paris: Masson et Cie. 7s. 6d.

THIS is in no sense of the word a text-book. It consists of a series of articles, well illustrated by descriptions of actual cases, diagrams, and X-ray photographs. The style is delightful, interesting, and fluent, but free from that apparent inconsequence so often found in French scientific works which strikes the English reader as almost frivolous. As with most French writers, the author's powers of clinical observation and description are beyond praise, and the material at his disposal must have been colossal.

The book is divided into sections on congenital and acquired disabilities. Of congenital disabilities Professor Léri takes first those caused by spina bifida occulta, and makes out a strong case for ascribing to this defect certain trophœdemata, sclerodermata, late paralyses, and, last but not least, certain cases of enuresis. In this last section he strikes new ground in claiming that a number of cases of enuresis resistant to ordinary medical therapy have been proved to be due to an obstructing band in the neighbourhood of a spina bifida occulta, and have been instantly cured by the removal of the same.

Next he considers the possible effects of errors of differentiation in the different sections of the spine. Our favourite section of the book is that devoted to sacralization of the 5th lumbar vertebra and lumbalization of the 1st sacral vertebra. These have hitherto received more study in America than in Europe, and we welcome Professor Léri's views as recognizing the importance of these deformities, while striking a very much more just balance than most American authors in ascribing

the production of symptoms thereto. Especially are we pleased to note that he puts quite as much blame on the erratic 1st sacral as on the erratic 5th lumbar.

The section on cervical rib is an excellent morphological study, but is less important from a therapeutic point of view. Spondylose rhizomélique receives careful study, as befits a French observer, and the conclusions drawn from observations seem sound. It is a rare disease, and the dual causes of infection and compensatory fixation are well put forward. Crush fractures of the vertebræ are said to be quite common, and with this observation we entirely agree. The results of burial by shell-bursts in the late war have shown us how slight may be the immediate effects of such fractures, and these observations have led to more frequent skiagrams of the spine in cases of obscure backache, and the discovery that crush fractures may easily be produced by quite moderate violence. The concluding section on localized rheumatic affections of the spine is a convincing and profound attempt to reduce to order the rather vague conceptions too frequently held on this subject.

We can confidently recommend Professor Léri's book to the attention of all orthopædic surgeons, and shall hasten to investigate these affections in the light of his observations. He promises us a companion volume on diseases of the bones and joints (excluding the spine), to the appearance of which we look forward with pleasure, and shall expect to find therein as great a stimulus as in the present volume.

Infections of the Hand. By LIONEL R. FIFIELD, F.R.C.S. (Eng.), Surgical Registrar and First Assistant and Demonstrator of Anatomy, London Hospital, etc. Crown 8vo. Pp. 192 + viii, with 67 illustrations, including 2 coloured plates. 1926. London: H. K. Lewis & Co. Ltd. 9s. net.

WE cordially welcome this book because it gives a good account of important work, e.g., that of Kanavel, which hitherto has been difficult of access to English readers. The great wealth of diagrams and drawings makes the chief anatomical points and their surgical bearing quite clear, but we do not find all the descriptive matter in the text easy to follow, and we fear it might be confusing to those who had forgotten their ordinary anatomy. We also regret that the description of small artificial spaces like that called Perona's space is included, because this introduces unnecessary complexity into the subject. However, these are but small matters, and the main lines of tendon-sheath, fascial-space, or lymphatic infection are well described, and their treatment is placed on sound lines.

Surgery of the Colon. By F. W. RANKIN, A.M., M.D., F.A.C.S., Visiting Surgeon to St. Joseph's and Good Samaritan Hospitals. Surgical Monographs under the supervision of DEAN LEWIS, A.B., M.D., EUGENE H. POOL, A.B., M.D., and A. W. ELTING, A.B., M.D. Imperial 8vo. Pp. 366 + xiv, illustrated. 1926. New York and London: D. Appleton & Co. 21s. net.

THIS book, as the author says in his preface, makes no attempt to express any arbitrary opinion of his own, but is a compilation and comparison of the sentiments of surgeons of wide experience. The literature has been reviewed thoroughly with the idea of correlating the views of various authorities in dealing with surgical conditions of the large bowel, excluding the rectum, and more especially malignant disease. There are eighteen chapters; the first is devoted to anatomy, and each of the following deals at some length with one of the seventeen lesions to which the colon is liable; at the end of every chapter is a comprehensive bibliography.

We think all the sections are excellent, and if we were to give particular notice to any one, it would be to that devoted to carcinoma of the colon. The author has evidently laid himself out to deal more exhaustively with this subject than with any other, and this is as it should be, for carcinoma is the most important surgical disease of the colon, and the differences of opinion with regard to treatment are perhaps more noticeable in the literature of this disease than in any other. As the author points out, the right and left colon are so different in anatomy and function

that they cannot be considered together for purposes of treatment. Opinion seems to be generally tending towards removing growths in the former, in the absence of acute obstruction, in one stage, and in the latter in two stages. He quotes mortality statistics from many eminent sources in substantiation of his views. Though the appropriate treatment is indicated in each chapter, it is only in the one on carcinoma that technical details are entered into at all fully, and here considerable prominence is given to the various methods of aseptic resection.

The last chapter is a short one dealing with intestinal stasis. No definite line of treatment is indicated, though the author leans towards a conservative policy, and this, in our opinion, is the proper position in which to leave the subject at the present time, for it cannot be said that there is any unanimity in this respect when authoritative opinions are so far apart as to regard this disease on the one hand as never requiring surgical treatment and, on the other, as needing removal of the entire colon.

In some regions of the body surgical principles and technique have reached a stage of excellence from the point of view of both morbidity and mortality results beyond which expectation of improvement is hardly reasonable; this cannot be said of the colon, and in these circumstances a comprehensive review of authoritative opinion from time to time is desirable and necessary. This book fulfils these considerations excellently, and we strongly recommend it from this point of view.

Etudes sur la Tubage Duodénale—l'Epreuve de Meltzer-Lyon. L'Alimentation duodénale. By Dr. R. DAMADE (Bordeaux). Royal 8vo. Pp. 91, with 7 illustrations 1926. Paris: Gaston Doin et Cie. Fr. 15.

THIS is a small brochure of ninety-one pages which deals with: (1) The test of Meltzer-Lyon; (2) Duodenal feeding. The method of carrying out the Meltzer-Lyon test, its physiology, and its application to diagnosis and treatment occupy the first part. The second portion gives a full account of the technique of Einhorn's method of duodenal feeding, together with the indications and results. Thus, in a very short space will be found a most reasonable and sane account of a method of diagnosis and of treatment which certainly appears to have a place in the study of gastroduodenal disorders.

Die Klinik der bösartigen Geschwülste. Edited by PAUL ZWEIFEL and ERWIN PAYR (Leipzig). Vol. III. Pp. 656 + xvi, with 184 illustrations in the text, and 44 coloured plates. 1927. Leipzig: S. Hirzel. Unbound, M. 76; bound, M. 85.

THIS is the third volume of a large work on malignant tumours in all parts of the human body. This particular volume deals mainly with malignant tumours of the female generative apparatus, including the breast. It is a large, cumbrous publication, but well illustrated with many coloured drawings. It is intended for the use of practitioners in order to give them the latest ideas on technique and treatment of malignant disease. Of its kind it is quite good, and the indications for the alternative treatment of X rays and radium are discussed with some care.

Diseases of the Nose and Throat, comprising Affections of the Trachea and Œsophagus. A Textbook for Students and Practitioners. By Sir STCLAIR THOMSON, M.D., F.R.C.P. (Lond.), F.R.C.S. (Eng.). Third edition. Medium 8vo. Pp. 943 + xvi, with 379 illustrations in the text, 12 black and white, and 12 coloured plates. 1926. London. Cassell & Co. Ltd. 45s. net.

THE appearance of a third edition of this work is very welcome. The first edition was published in 1911 and it then obtained universal approval. The rapid advance in this specialty has necessitated a somewhat extensive increase in the size of the

present volume. The fact, however, that the changes made are in the direction of addition, rather than alteration, speaks for itself. The first edition could be regarded as a standard by which other text-books should be judged. It was both complete and concise, and it showed a breadth of outlook unfortunately somewhat rarely met with in the specialist. Both letterpress and illustrations were excellently produced, and printer's errors were conspicuous by their absence. As far as the new edition is concerned, it need only be said that the former high standard has been maintained or enhanced. Amidst an enormous mass of new material, the choice of what to include and what to omit has been made with very sound judgement. The amount of new work entailed in the preparation of this edition must have been very great, and the profession owe a debt of gratitude to Sir StClair Thomson in that he has given to them so generously of his ripe experience.

Cavernous Sinus Thrombophlebitis and Allied Septic and Traumatic Lesions of the Basal Venous Sinuses. By WELLS P. EAGLETON, M.D., Newark, N.J. Post 8vo. Pp. 195 + xxiii, illustrated. 1926. New York: The Macmillan Company of Canada Ltd. $4.50.

THIS study is based on the author's experience of a series of twenty-five cases, which, in dealing with a somewhat rare condition, must be accounted a considerable number. These cases are reported in great detail. The material is classified in accordance with the route by which infection has reached the sinus. The importance of early diagnosis, without waiting for the development of such classical signs as exophthalmos, etc., is emphasized, if the results of operation are to be better in the future than they have been in the past. In regard to operation, the somewhat surprising suggestion is made that it may be advisable to ligate the common carotid, so that the cessation of pulsation may give rest to the inflamed sinus. The work embodies a considerable amount of research, has an extensive bibliography, and obviously embodies the result of much thought. The superabundance of detail does, perhaps, tend to obscure to some extent the broad principles involved.

Bernhard Heine's Versuche über Knochenregeneration, sein Leben und seine Zeit. By Dr. K. VOGELER (Berlin), Dr. E. REDENZ, Dr. H. WALTER (Würzburg), and Professor Dr. B. MARTIN (Berlin), with a Preface by Professor H. BIER. Medium 8vo. Pp. 224, with 105 illustrations in the text and one portrait. Published by the German Surgical Society. 1926. Berlin: Julius Springer. Reichsmarks 7.50.

BERNHARD HEINE, who was born in 1800 and died in 1846, worked chiefly at the University of Würzburg, and has left to that institution a remarkable collection of instruments and specimens chiefly dealing with the growth and regeneration of bone. In the first place there is a comparatively complicated mechanically-driven saw or osteotome by means of which Heine cut the bone in his experiments. Then there are about one hundred specimens from the skull and limb bones of dogs showing the results which followed removal of parts of the bone, the periosteum, and the marrow. The conclusions which Heine reached were very similar to those of Ollier, and pointed to the periosteum as being the main factor in osteogenesis. The careful details in every experiment and the preservation of these specimens of one hundred years ago make this monograph one of great interest and importance.

Travaux de la Clinique chirurgicale de la Salpêtrière. By A. GOSSET, Professeur de Clinique chirurgicale à la Faculté de Médecine de Paris; Chirurgien de la Salpêtrière. Vol. I. First series. Imperial 8vo. Pp. 254, with 118 illustrations. 1926. Paris: Masson et Cie. 8s. 4d.

THIS is a new work, and one which is well worth perusal. It is compiled by Monsieur Gosset, who is Professor of Clinical Surgery in the Faculty of Medicine in Paris and Surgeon to the Salpêtrière, in collaboration with fourteen others who hold important positions in the medical world of Paris.

One may describe the volume as the collected papers of Gosset and his co-workers and a reflection of their activities. The articles, which number sixteen, include "Choledochotomy for Lithiasis" (A. Gosset), "Cholecystography" (Gosset and Loewy), "Formation of White Bile" (Gosset and Bertrand), "Gliomatosis of the Stomach" (Gosset and Bertrand), "Pyloroplasty by the Flap Method" (Marcel Thalheimer), and others interesting both to surgeons and clinicians. There is also a very interesting paper on "Tumours of Plants" by J. Magrou, in which the recent developments of the *Bacterium tumefaciens* are discussed. It may seem strange to find such a paper in a surgical journal, but it appears to illustrate the wide outlook of Professor Gosset, who, in 1923, annexed to his surgical clinic in the Salpêtrière a laboratory of vegetable biology. It is certain that the study of the tumours of plants is of great interest in comparative pathology and may perhaps throw light on the problem of human tumours.

The whole volume is well printed and illustrated, and is a worthy addition to surgical literature.

Principles and Practice of Oral Surgery. By S. L. Silverman, D.D.S., F.A.C.D., Clinical Professor of Oral Surgery, Atlanta-Southern Dental College, etc. Medium 8vo. Pp. 326 + xvi, with 280 illustrations. 1926. London: Henry Kimpton. 25s. net.

In England it is the usual practice for the minor surgical operations in the mouth to be carried out by dental surgeons and the major operations by general surgeons. In America during recent years the trend has been to promote the surgery of the mouth and associated parts to a specialty, and certain of the medical colleges have founded chairs of oral surgery, these positions in some cases being held by men possessing the dental qualification only. The result of the elevation of oral surgery to a specialty has been the appearance of books devoted to this branch of surgery, and of these that by Dr. Blair is perhaps the best known in this country.

Dr. Silverman's book, which is the latest addition to this group of works, runs into just over three hundred pages and is lavishly illustrated. The treatment of the different subjects is unequal—for example, nearly one quarter of the book is devoted to cleft lip and cleft palate, while the important operations of removal of the maxilla, the mandible, and the tongue are dealt with in twenty pages. The chapters on cleft lip and palate are the best in the book, the technique of the various operations being described in clear terms. The author would appear to be an advocate of Brophy's operation, which has not found much favour in this country, and he gives answers to the usual objections urged against this operation. The chapters dealing with alveolectomy, apico-ectomy (amputation of the apex of a tooth root), and misplaced teeth contain useful information, and the operations are described in detail. It is the chapters dealing with major operations that are disappointing; they are too brief to be of value—for example, in that on the tongue there is no description of the operation for the removal of the affected lymphatic glands. Amongst surgeons in this country, importance is placed upon rendering the mouth free from dental sepsis, and there are certain writers who advocate the removal of all the teeth before carrying out major operations. This debatable subject is not touched on by the author. It has also become a practice to leave wounds in the mouth open, but if one judges the author correctly, he would appear to be in favour of packing with 5 per cent iodoform gauze over a fairly prolonged period.

The chapter on fractures of the jaw is too brief; there is a good description of fixation of the fracture by intermaxillary wiring, but scant reference to the methods of reducing some of the troublesome displacements met with from time to time. In the short chapter on plastic surgery the author insists—and rightly—on the restoration of teeth and bone by surgical or prosthetic means before carrying out plastic operations. A short account is given of maxillofacial prosthesis, and this includes an illustration of a lady putting the finishing touches on a 'reconstructed mask'.

The book, we feel sure, will be found of more value to the practitioner who limits his surgery to the minor operations of the mouth than to the one who undertakes the major operations.

Saint Bartholomew's Hospital Reports. Edited by W. McADAM ECCLES, Sir THOS. HORDER, Bart., K.C.V.O., Sir BERNARD SPILSBURY, W. LANGDON BROWN, W. GIRLING BALL, and GEOFFREY EVANS. Vol. LIX. Demy 8vo. Pp. 206 + xxviii. 1926. London: John Murray. 21s. net.

OF the papers of surgical interest in this volume that by Girling Ball on perforated ulcers in the stomach and the duodenum is the most considerable. The author collates some 500 cases, of which 50 have been under his own care; these are dealt with in detail and their symptomatology is critically analysed; their number, however, is too small to allow the author to draw any definite conclusions from the relative value of suture with or without short-circuiting.

In the treatment of true fractures of the neck of the femur Mr. Elmslie agrees with the line of treatment advocated by Whitman, and gives a useful review of the subject.

Though without direct surgical interest, the most fascinating paper in the volume is Sir D'Arcy Power's account of the rebuilding of the hospital in the eighteenth century, which will be eagerly read by all those interested in the history of such institutions.

Guy's Hospital Reports. Edited by ARTHUR HURST, M.D. Vol. LXXVI (Vol. VI, Fourth Series), Nos. 2 and 3. Royal 8vo. Pp. 125 (each). Illustrated. 1926. London: Wakley & Son (1912) Ltd. Annual subscription, £2 2s. net; single numbers, 12s. 6d. net.

THESE reports continue to reflect the work of the staff of Guy's Hospital. The outstanding feature is a continuation of "Studies on Tumour Formation", by G. W. Nicholson (in No. 2, Vol. VI, April, 1926). This article gives an account of tumours of endometrial origin, tumours found in the groin and round ligament, in the umbilicus, and in laparotomy scars. It is an article of great pathological interest.

Guy's Hospital Reports. Edited by ARTHUR HURST, M.D. Vol. LXXVI (Vol. VI, Fourth Series), No. 4, October, 1926. Royal 8vo. Pp. 120. Illustrated. 1926. London: Wakley & Son (1912) Ltd. Annual subscription, £2 2s. net; single numbers, 12s. 6d. net.

THIS volume contains an article of great interest to the general surgeon. This is an analysis of the results of treatment of carcinoma mammæ by J. F. Carter Braine. The investigation concerns the fate of 722 patients admitted to Guy's Hospital during a period of thirteen years, namely, 1909–22. The following is Mr. Braine's summary of the analysis: "(1) In late cases the less extensive the operation the longer the life of the patient. (2) In late cases extensive operative interference leads to rapid dissemination and metastasis, and frequently does not confer a greater length of life than is to be expected when operation is withheld. (3) The operative mortality in all cases was 3·3 per cent. (4) Of all verified cases treated by operation, 54·1 per cent were alive at 3 years, and 28·4 per cent were alive at 5 years. (5) When the axillary glands were not invaded by growth at the time of operation, the prognosis was very materially improved: 86 per cent of such cases were alive at 3 years, and 46 per cent at 5 years. (6) When the axillary glands are invaded by growth the prognosis is less favourable; 45·8 per cent of such cases were alive at 3 years, and 18·8 per cent at 5 years. It is probable that the majority of the total number of cases in the series belonged to this category. (7) Superficial radiation applied immediately after the operation has definitely improved the prognosis of the disease. (8) More than half the recurrences after operation were found in the scar and adjacent skin, and more than a quarter in the axillary glands. Both were relatively early in their appearance."

Report on Third International Congress of Military Medicine and Pharmacy. By Commander WILLIAM SEAMAN BAINBRIDGE, M.C., United States Naval Reserve Forces, Member of Permanent Committee, Delegate from the United States. Demy 8vo. Pp. 111 + viii, with numerous illustrations. Reprinted from *The Military Surgeon*. 1926. Washington: Association of Military Surgeons.

THIS is a short report on the Third International Congress on Military Medical Subjects held since the war. The first was in Brussels in 1921, the second in Rome in

1923, and the third in Paris in 1925. At this last Congress forty-two countries were represented, but these did not include the Central Powers. More than 2500 delegates of the forty-two nations represented participated in the Congress, and there were in addition many visitors. The main subjects discussed at the present Congress were as follows: Technical specialization as the basis for the functioning of the medical services in war time; selection of the troops with especial regard to tuberculosis and affections of the ears and eyes; dressing and suture material; and the etiology and treatment of traumatic arthritis. There were also a number of short communications on special subjects.

The present report gives a good general idea of the scope and work of the Congress, and will enable anyone interested in any special subject to refer to the original and official transactions. The illustrations are chiefly photographs of prominent officials and groups of delegates who took part in the Congress.

Chronic Intestinal Stasis (Arbuthnot Lane's Disease). A Radiological Study. By ALFRED C. JORDAN, C.B.E. M.D. (Camb.), M.R.C.P. (Lond.), Corresponding Foreign Member, Belgian Royal Academy of Medicine. Second edition. 4to. Pp. 230 + xv, illustrated. 1926. London: Humphrey Milford. 21s. net.

THE work is dedicated to Sir William Arbuthnot Lane, 'the Father of Stasis'. The latter, in a foreword to the book, states: "As time goes on the profession will see that the disturbances of metabolism, and the absorption of toxins from the gastro-intestinal tract, due to stasis, are of enormous importance; many surgical operations, at present needed, will fall into disuse. Early treatment is essential to prevent the many serious consequences of neglected stasis, most of which are graphically demonstrated in this work. Numerous diseases, at present the bane of civilized man, will disappear, once they are recognized to be the result of auto-intoxication and the conditions of life adapted to the preservation of healthy bodies. This is no utopian ideal, but the real foundation of medicine".

Dr. Jordan is well known as an original worker in radiology, and he has been prominent in the use of X rays almost since the original discovery by Röntgen. During the years that have elapsed he has been conspicuous by his original methods and technique, and he has advanced a number of theories in connection with diagnosis which must command our attention. The fact that many of the hypotheses he puts forward have not been universally accepted need not concern us in the estimation of his work on the whole, and in particular on the merits of this book. Much of the technique described is extremely sound, and with certain reservations it can be approved of as a method to follow in gastro-intestinal investigation, or as confirmatory of other methods. He has elaborated a thoroughly reliable method of screen examination, by the use of which he has made a number of observations of fundamental importance for the guidance of other workers. Many of the conclusions he arrives at in his book are the result of these screen observations, and as such they must be given a certain value. The radiographic evidence he puts forward is frequently not confirmatory of his screen observations, but such a criticism is applicable to the work of many other recognized authorities in radiology. The failure to confirm essential points made on the screen by radiographic reproduction need not be regarded as condemnatory of the former.

The methods of protection for the patient and the operator are reliable and worthy of adoption; the proof of the efficiency of the author's methods lies in the fact that he has used them for many years and has escaped serious damage. A further point is that Dr. Jordan introduced these methods at a time when the dangers were not generally appreciated and other workers were being damaged.

The work under review is in part the accumulated experience of years of active collaboration with Sir Arbuthnot Lane, and it is not surprising that many of the explanations given are based on the theories first enunciated by that eminent authority.

The book is more than a radiological study of chronic intestinal stasis; it also contains a section on treatment, and there is much in this part of the volume that

will be of service to the practitioner. The radiological portion of the work is sound, though not all radiologists will agree with many of the explanations given in the text of conditions which are commonly met with. Dr. Jordan is ambitious, and ventures into fields in which many able practitioners have wandered and become lost.

In the treatment of the manifold manifestations of the disease described in some detail, Dr. Jordan concludes: "I have endeavoured to point out the far-reaching consequences and dangers of neglected stasis, and shall conclude this chapter by outlining the means that should be taken to prevent the occurrence of cancer". The last part of this chapter is prophetic rather than useful. "Although we have not yet found the full solution of the cancer problem, may we not justly believe that we are at the dawn of a new era in the prevention of this dread disease?" Obviously Dr. Jordan believes that in putting forward chronic intestinal stasis as an explanation of the appearance of cancer, he is on sound ground; but it is asking too much to expect that these statements shall be taken seriously by research and clinical workers, who are diligently seeking for the cause and cure of cancer. It is difficult to follow the reasoning underlying the explanation of the production of toxæmia and sequelæ due to stasis in the alimentary canal; it is even more difficult to refute the conclusions, since many of them are ill-conceived, and based on an imperfect appreciation of physical laws and pathological conditions arising in association with stasis or, as is more probable, accompanying it. Is it logical in the first place to regard the condition as a disease, and from that hypothesis to ascribe such widely separated maladies as epilepsy, melancholia, suicidal mania, cancer of the breast, gall-stones, etc., to chronic intestinal stasis? On reasoning such as this there is practically no disease to which man is liable that cannot be explained by the effects of toxic absorption from the intestinal canal.

The volume under review is the second edition of the work; following so quickly on the first edition it is evident that the book has been widely read. Dr. Jordan is to be congratulated upon an interesting study of a condition of frequent occurrence in practice.

X-ray Diagnosis: A Manual for Surgeons, Practitioners and Students. By J. MAGNUS REDDING, F.R.C.S., Senior Surgical Radiologist to Guy's Hospital. Medium 8vo. Pp. 228, with 80 skiagraphic plates. 1926. London: Cassell & Co. Ltd. 21s. net.

THE author, in the preface of this admirable work, says: "In writing this book I have endeavoured to outline the guiding principles of radiographic diagnosis in the examination of those tissues whose structure renders them demonstrable by radiation. With this aim in view, the descriptions of the lesions affecting the different anatomical systems are preceded in every instance by an analysis of the appearances produced by the normal structure, and of the modifications of those appearances which result from disease. It is hoped that a basis for logical interpretation is in this way provided. It must be remembered that the ultimate aim of the examination is the formation of a reasoned diagnosis, and that without the requisite knowledge to arrive at this end the most perfect technical results are of no avail".

An author who sets out with such a clearly arranged objective, and succeeds in its execution as Dr. Redding has done, is bound to produce a work of some importance. In this instance the result is a handbook which amply fulfils the aims of its author, who states: "My hope is that the book may prove useful to the surgeon and the practitioner whose work brings them into constant touch with radiology, but who have had neither the time nor the facilities for making a special study of the subject; to the post-graduate preparing for the higher medical and surgical examinations and the diplomas in radiology now granted by the Cambridge and Liverpool Universities; and to the undergraduates studying for the pass examinations, to whose curriculum of obligatory subjects radiology has lately been added". For the purposes of the diploma candidates more information will be required on technique, but with this exception the candidate who masters the contents of the book should have no difficulty in satisfying the examiners. The

student, to whose burdens the science of radiology has been added, will find in its pages ample information for his needs.

The book is well planned; nothing of importance has been omitted, and much appears which will be of interest and use to the experienced radiologist, who time and again has to refresh his memory on essential points in anatomy and the interpretation of the normal and departures from it.

The illustrations are on the whole well chosen, and all are reproduced in half-tones on special paper, so there should be no excuse for any loss of detail in the reproduction of the skiagrams. One objection must be made; many of the skiagrams are reduced too much; detail is lost, and in several instances the size of the reproduction is out of all proportion to the space allowed on the plate; a larger size would have added to the value of the skiagrams. A number of the half-tones are below the average of first-class radiography of the present day. No doubt in a subsequent edition, which must soon be called for, these slight detractions will be removed, and better skiagrams take their place.

Mr. Redding has to be congratulated upon the result of his labours, and we welcome this work as a valuable contribution to radiography and one which will take a high place amongst the works on this subject in the English language.

Handbook of Medical Electricity and Radiology. By JAMES R. RIDDELL, F.R.F.P.S., Lecturer on Electrical Diagnosis and Therapeutics, University of Glasgow; Radiologist, West Infirmary, Glasgow, etc. Crown 8vo. Pp. 239, with 110 illustrations. 1926. Edinburgh: E. & S. Livingstone. 8s. 6d. net.

THIS book has been written with the object of providing the student with a short and simple description and explanation of the various radiotherapeutic, actinic, and electrical agents used in the treatment of disease. The description of apparatus and technique is clear and simple. The statements concerning the indications for various types of treatment are necessarily too brief and dogmatic to allow of any discussion—for example, it is a matter of opinion whether "Patients suffering from neurasthenia are improved by general applications of electricity in any form" (p.31). The diagrams of anatomy and apparatus are very good because of their simplicity, but the reproductions of radiograms are too small and indistinct to be of much value. Perhaps the author has attempted to cover too large a range of subjects in the compass of a small book, but he has succeeded in giving much useful information in a very readable form.

Light Treatment in Surgery. By Dr. O. BERNHARD (St. Moritz). Translated by R. KING BROWN, B.A., M.D., D.Ph., Medical Officer of Health, Bermondsey; Lecturer in Public Health, Guy's Hospital Medical School. Medium 8vo. Pp. 307, illustrated. 1926. London: Edward Arnold & Co. 21s. net.

DR. BERNHARD'S book, in the words of Dr. Leonard Hill in the foreword introducing the work, "is a masterly production, the fruit of thirty years' work, carried out by one of the greatest, if not the greatest pioneer of heliotherapy in the High Alps". Readers of the book in this country owe a great debt to Dr. King Brown, who has spared himself no trouble in giving a faithful and excellent rendering into English.

The book abounds in informative data of the important steps in the development of heliotherapy. The most striking tribute to individual effort on the clinical side is that Dr. Bernhard has limited the number of beds in his sanatorium to thirty-three, holding that such a number is essential to ensure each patient's receiving his individual attention. This may explain the evidence he puts forward of good clinical results, and the minute detail with which he describes the clinical conditions. Pioneer work in all branches of medicine calls for such meticulous care in its execution.

The opening chapter is historical, and is a delightful résumé of the uses of light treatment throughout the ages, from the classical days downwards. The chapter is a clear proof of the value of a sound classical education as a preliminary to the

study of medicine. Modern light therapy has been built on the third component of light, that is on the chemically active rays. The foundation stone was a knowledge of the bactericidal action of light.

An important chapter is that on light and light biology, in which many interesting points are discussed. The biology of light must ever be an important subject on which the basis of radiation therapy is founded. The experiments of Oerum and Bering are quoted as important in the explanation of the effect of light upon the blood. Oerum found that in rabbits kept in the dark and in red light there was a diminution in the number of red corpuscles and the hæmoglobin content, as well as a reduction of the quantity of the blood. Diffuse daylight and blue light, on the other hand, produced a considerable increase in the quantity of blood, along with an absolute increase of the total hæmoglobin. After a light bath of four hours rabbits showed a 25 per cent increase in the amount of their blood. The chemistry of light biology is dealt with in a most interesting manner.

The pathology of sunlight has a complete chapter devoted to it, and it precedes the description of the various forms of light treatment and the technique of their use. So the beginner is first initiated into the dangers arising from the injudicious use of these powerful rays. The important subject of light sensitizers is dealt with in a thorough manner, and the method of their action is explained. It is important to remember that exposure over a long period of time, though intermittent, may lead to the development of chronic dermatitis, but Bernhard is not inclined to agree that carcinoma may supervene in these cases. At the end of the chapter on light therapy several important rules are enumerated under headings: (A) Local irradiations; and (B) General irradiation.

Light therapy is dealt with under these main headings: (A) Sunlight therapy; (B) Therapy with artificial sources of light. The latter gives a full description of the forms of lamp used. A short reference is made to the Röntgen rays; further on in the book the use of these rays is dealt with in detail in connection with the treatment of surgical tuberculosis.

This handbook is a most complete treatise on the increasingly important subject of light treatment in surgery, and as such it is incomparably the best yet published. It is most instructive in its detail and full of the most convincing arguments in favour of the use of these powerful aids to surgical treatment.

The author is an accomplished physician, well versed in the historical developments of his subject, a man of profound learning, and an able clinician. The clinical data have been dealt with in a most painstaking manner; the result is a very informative treatise, which must be of the greatest service to all who are interested in this work. The author is to be heartily congratulated on the able manner in which he has put on record the summation of the labour of years, and his book cannot fail to meet with universal approval.

L'Anesthésie tronculaire des Machoires, par Voie buccale. By Dr. ROGER DUCHANGE. Medium 8vo. Pp. 112, with 24 illustrations. 1926. Paris: Masson et Cie. Fr. 2 (suisses).

THIS small monograph is by the same author as the important work on fractures of the jaws and their treatment. It consists of a careful and detailed account of the anatomy of the nerve-supply of the lower and upper jaws and of the methods of injecting local anæsthetic solutions through the oral approach into the nerve canals. A few line drawings serve to illustrate the main anatomical facts. In discussing the most important problem—namely, the practicability of injecting the foramen ovale—the author advises the use of a special gag and guide, and it is unfortunate that the illustration of this in use (*Fig.* 8) is very far from clear.

Except in cases where actual infection has occurred in the track which would have to be followed by the needle, and in cases of intractable trismus, the author considers that regional anæsthesia should be used for all jaw operations. We believe that few patients would share this view if they understood the pros and cons of alternative methods.

Handbuch der Massage und Heilgymnastik. By Dr. FRANZ KIRCHBERG, Lecturer in Massage at the University of Berlin. Vol. I. Royal 8vo. Pp. 274, with 71 illustrations in the text and 19 plates. M. 14.70. Vol. II. Pp. 334, with 23 illustrations. M. 15.

Massage und Gymnastik im Dienste der Kosmetik. By Dr. FRANZ KIRCHBERG. Crown 8vo. Pp. 99 + v, with 29 illustrations. 1926. Leipzig: Georg Thieme. M. 3·90.

THESE two books on massage and remedial exercises give a very full and complete account of the subject. In the handbook an introductory account is given of the history of the art of massage, tracing it back to Chinese and Indian, Greek, and Roman practice. Continued on more or less empirical lines through the Middle Ages, it was raised to the standard of an exact science by Henrik Ling, to whom Sweden owes her fame in regard to this subject. The first volume is concerned with a description of the technique of massage and a discussion as to its mode of action, and is exceedingly thorough and clear in all details. The plates at the end of the volume are from photographs illustrating the different kinds of massage and movements.

The second volume of the handbook deals with the application of massage and exercises in the treatment of various diseases and injuries. The following organs or system of organs are discussed in their relation to massage: circulatory system; abdominal organs, especially with regard to enteroptosis and constipation; organs of respiration; urino-genital apparatus; nervous system, including the treatment of various types of paralysis; bones, muscles, and joints, including fractures and sprains; the auditory apparatus; and the mucous membrane of the upper air-passages.

Drs. Koch, Seele, Koblanck, Echtermeyer, and Professor Grossmann have collaborated in special subjects, i.e., fractures, dislocations, diseases of women, aural surgery, and nasal surgery. The handbook is a most useful guide to practice, and invaluable as a book of reference.

The small book by Dr. Kirchberg on massage in relation to beauty preservation is apparently an attempt to supply information to those who take up this type of practice without a general training..

Die akuten eitrigen Infektionen in der Chirurgie und ihre Behandlung. By Dr. ARTHUR BUZELLO. Royal 8vo. Pp. 495, with 175 illustrations. 1926. Berlin and Vienna: Urban & Schwarzenberg. Bound, M. 34·50; unbound, M. 30.

THE intention of this work is to provide for the student and young practitioner a guide both in the understanding of the acute suppurative infections of surgery and in modern methods of treating these conditions. This is a branch of surgical work from which the general practitioner earns his 'daily bread', and, to some extent, the teaching of the student is here deficient, because a very large amount of his time is spent on the more easily taught subjects which are of greater interest to the specialist. This, no doubt, is truer in schools where the specialist clinic system is most developed, but in Britain, where the surgical teaching is done largely by general surgeons, the problem is not so acute as that pictured by Dr. Buzello for the Continent.

In this book there is first a chapter dealing with general aspects of the subject, including sections on nomenclature, body defences, bacteriology of the pyogenic organisms together with elementary laboratory technique, and special methods of treating suppurative conditions. The main part of the volume deals systematically with the suppurative infections under the following headings: wound infection, skin and subcutaneous tissues, whitlow, bones and joints, bursæ, lymphatics, connective tissues and glands (including the breast, kidney, lachrymal sac, spleen, prostate, etc.), mucous membranes, blood-vessels, pleura and peritoneum (including empyema, lung abscess, subphrenic abscess, appendicitis, cholecystitis, peritonitis, and pelvic abscess), decubitus, tetanus, anthrax, and noma. Finally, there is a chapter on the septic general infections.

As in all such piecemeal books for the student, it is possible to bring forward criticisms in the way of errors of both omission and commission in the choice of subjects. Apart from this, we would have desired fuller details of treatment in some subjects—e.g., the Carrel-Dakin method of wound irrigation and treatment with B.I.P.P. The chapter on whitlow would have been much better if reference had been made to Kanavel's work on the infections of the hand. Nevertheless, the general standard of the book is excellent.

Ausgewählte chirurgisch-klinische Krankheitsbilder. From Sauerbruch's clinical lectures. Arranged by Professor Dr. GEORG SCHMIDT. Part I. Crown 8vo. Pp. 84. 1926. Berlin: Julius Springer. Reichsmarks 2.70.

THIS little pamphlet is the first of a series, and consists of a selection of ten clinical lectures of Sauerbruch. They cover the following ground: exophthalmic goitre, endemic cretinism, burns, carcinoma of the breast, hydrocele, prostatic hypertrophy, congenital talipes, perinephritic abscess, carcinoma of the tongue, and hare lip. Enabling the listener to get a picture of the disease in all its aspects, and conveying to him personal views of the lecturer, this is a very valuable form of surgical teaching. The above are perfect models of what such should be; and, although in the printed word some of the 'atmosphere' of the clinical lecture is of course lost, Dr. Schmidt is to be congratulated on giving us so great an insight into the methods and personality of such a distinguished teacher.

Die Vorbereitung zu Chirurgischen Eingriffen. By Dr. JOH. VOLKMANN, Privatdozent in the Surgical Clinic of the University of Halle. Medium 8vo. Pp. 238 + x. Illustrated. 1926. Berlin: Julius Springer. Reichsmarks 12.

THIS is a small work dealing with the examination and preparation of patients before operation, and is intended for students, medical practitioners, and young assistants, who find themselves in the position of having to handle patients alone and without previous experience. It is a compact and comprehensive volume and may be useful to those who read German.

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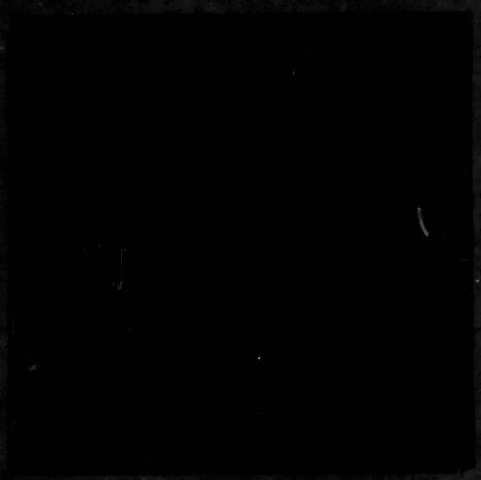

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